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IN retiring from the active editorial direction of the *Electrical World*, which action coincides with the publication of this issue, I wish to assure the body of readers whom I have had the privilege and pleasure of serving for the past nineteen years that my interest will continue unabated in the profession and the industry of which they form a part, in the ideals toward which they are striving. Indeed, freedom from routine will, in a sense, strengthen rather than relax devotion to the science and the art and the industry which have solely occupied my thoughts during so many years, to serve the best interests of which has never been a task and will never cease to be a pleasure. In now answering the call of personal interests that have suffered neglect—for the work of an editor demands single-minded, concentrated effort—I wish to record my keen appreciation of the warm support of Mr. James H. McGraw, of his constant encouragement toward rendering the *Electrical World* editorially worthy of the high place in technical journalism it has sought to occupy. I also desire to acknowledge the loyal collaboration of my editorial colleagues, with whom it will be my privilege to continue association in a consulting capacity, who have devoted without stint their ability and energy in the cause for which the *Electrical World* stands—full and uncompromisingly independent journalistic representation of the great field of electrical activity. The *Electrical World* is an institution dependent not so much on one man's guidance as upon aims, policies and ideals. In the execution of policies, in their adaptation to changing needs, and in the achievement of aims and ideals, the *Electrical World* has a staff capable of meeting any demands that may be made upon it. This staff is not only an aggregation of able men; it is an organization carefully built up and highly trained. In the hands of this organization, and with the support and resources of its publishers, the conduct of the *Electrical World* and the maintenance of its position can suffer no retrogression.

W. D. WEAVER.

THE RETIREMENT OF MR. WEAVER.

For many years I have known W. D. Weaver as man, as engineer and as editor. More than that, he is my warm friend. Now that he is about to retire, we who have lived and worked with him have but one consolation—that we

are not to be deprived of his counsel nor shut off from the stores of his knowledge. He will be consulting editor of the *Electrical World*.

Mr. Weaver's character as a man possesses a peculiar charm born of the combination of many opposing attributes. With a modesty and gentleness so pronounced that it may be called invincible he has a virility of will and an independence of thought that have made him always a master and leader. With much of the artistic temperament and with the imagination to see things invisible to more prosaic minds he combines a rugged common sense that makes him practical and that has kept his feet on solid earth. A man of letters and of science given to abstractions and generalizations, he is never forgetful of the concrete and human side of human relations. A man of the world, a cosmopolitan with an extremely wide range of travel, observation and personal experience, yet he is simple, plain and unostentatious in his habits and mode of life. A man who knows guile, he is always rigorously honest and appreciatively sympathetic. Weaver is a real man, though he may be a little old-fashioned in that he is never boastful and delights in seeing credit given to others for things that he has done.

As an engineer Mr. Weaver has made his impress upon the electrical development of his time. The leaders in the profession of electrical engineering, both at home and abroad, have long recognized his unusual gifts and have been glad to work with him as a colleague entitled to the highest respect. But for his extremely retiring disposition he would long since have been clothed with the highest honors which it is within the power of the profession as a whole to bestow. As a student and expounder of principles and not infrequently as an active participant in work making for electrical progress he enjoys an enviable distinction.

As an editor Mr. Weaver achieved and scrupulously maintained the highest standards known in technical journalism. "Weaver is a great editor" is one of the truisms. To broad knowledge he added unwearied industry. To wide acquaintance with the men, events and traditions of the electrical industry he brought an inflexible courage and will to publish and to say what he believed to be right regardless of all considerations but the truth. These qualities were vitalized by a happy, buoyant love of his work. The organization of his staff was the democratic organization of a university faculty. Each man did his best because he looked upon his work as a professional opportunity. The perfection of balance and proportion in the selection of matter, the thoroughness, the scope and the accuracy with which developments in the whole field of electricity have been recorded and discussed, that indefinable but distinctly characteristic finish and polish which have been so notable in the pages of this publication, constitute the heritage which Mr. Weaver leaves to his successors.

That a long life of happiness and usefulness may follow his surrender of the intense activities he has until now pursued is the wish that goes with him from myself and his other associates, accompanied by full appreciation of his great services to technical journalism and to the electrical profession.

James H. McGraw.

THE PATENT HEARINGS.

The hearings now taking place before the patent committee of the House of Representatives on the so-called Oldfield bill for the revision of the patent laws, reported in part elsewhere in this issue, bring out strikingly the great diversity of opinion concerning the shape and form which such revision should take. That many of those who are vitally interested in this question have not yet formulated any constructive forward policy is evident from the character of responses made by witnesses on examination and cross-examination by members of the committee. Broadly, there seem to be at least four distinct groups concerned in this question, composed of inventors, patent lawyers and solicitors, manufacturers, and the general public; perhaps there ought to be added to these the wholesale and retail distributors of patented articles. The purely selfish interests of these groups are in conflict, and even within any given group there is no universal agreement as to what the policy should be. But it is no criticism, per se, to say of any group such as the attorneys, for example, that they oppose any change in the law which will diminish the volume of their business or income; it is rather a criticism of human nature. All questions of such a fundamental character seem unavoidably to bring selfish interests into conflict with the public interest and each other.

It is essential to have clearly in mind the great fundamental motive of our patent system, which has done so much to make us a powerful nation industrially. This motive is the stimulation of invention, to the end that the products of inventive minds may be given to the public for use and ultimately become common property. In so far, then, as the present law is out of harmony with modern economic and industrial conditions, selfish interests which have created business advantages under the old system should now make some sacrifice in the interest of the common good. What course or policy will best serve the general welfare cannot be made clear until all sides shall have had a full hearing. Chairman Oldfield of the House patent committee has made it very clear that the committee desires to hear everyone who is affected by the proposed revision of the patent system. The larger interests can be relied upon to take care of themselves in this situation, but the inventor and the small manufacturer are not always so alert in legislative matters. There is an opportunity for all to be heard, if no time is lost in making an appearance

at Washington, or in submitting briefs if attendance at the hearings is impossible. The great need of the moment is adequate and general recognition of the seriousness of the situation and the far-reaching consequences of any legislative action which protects special interests instead of the welfare of the nation as a whole.

STANDARDIZATION IN WIRELESS TELEGRAPHY.

In any art it is essential that a universal set of conventions be followed if the best progress is to be made. Delays due to lack of uniformity, while perhaps small in the individual instance, soon reach an appalling total and act vigorously in inhibiting development. In new arts, where novel ideas are constantly being put forward, if every student of the various problems involved is to benefit by the solution of others, standardization in expression of methods and results is especially desirable, and in radio-signaling, a new art of worldwide application, such agreement of expression is of unusual importance. Variance in definition and statement causes great inconvenience to those engaged in actual development of the science of wireless telegraphy and thus appreciably reduces their efficiency of production. At present the whole literature of the art is encumbered with double usage of terms, contradictory definitions, etc., which must be eliminated if the most rapid progress is desired. The international wireless conference arranged for at London in June offers a great opportunity for this work, and it is to be hoped that it may receive proper attention. When a large number of widely experienced engineers meet in this way, with a mutual interest in the welfare of a single art, work of the greatest possible benefit may be carried to completion. Now is the time to adopt a standard set of units and symbols and of measurements and rating, and to state definitions which will eliminate the present differences in nomenclature. If it had been possible to do this some years ago, the art would have felt a considerable impetus; in any event, the action should no longer be postponed.

As examples of present confusion, one may consider the use by many authorities of logarithmic decrement measured per complete period and by others at the equivalent per half period of oscillation, and also the unfortunate lack of distinction between antenna and "radiation" resistances. Transmitting outfits are rated in power input, without regard to efficiency. The term "frequency" is used both for the number of cycles per second and for the number of semi-cycles. Duplication of terms, such as "jigger" and "oscillation transformer" and "group frequency" and "spark frequency" often causes trouble to those who wish to keep in touch with the work of various investigators and yet who are not actually breathing the highly involved wireless atmosphere. Further opportunity for error and additional mental stress is caused by the lack of agreement in units used. Capacities are variously quoted in centimeters, micromicrofarads, millimicrofarads and microfarads; inductances in henrys, millihenrys, microhenrys and centimeters. Where these quantities are linked with wavelengths by the velocity expression it is necessary to choose between constants varying from 1.885 to 69,670 or more, according to the units used. The attendant liability of confusion could be avoided and computation much simplified by an agreement as to the most desirable group of units. In addition to all this, methods of measurement are at variance and in consequence many results are given in such loose form that they are of little or no value—in general for the reason that all possible variables have not been accounted for. As a rule, high-frequency measurements are especially critical, and the adoption of a set of well-tried measurement methods should go a long way toward producing reliable and interchangeable data. Some little work along these several lines has already been done by the two American wireless engineering societies, and now that they have joined hands it is anticipated that further steps will be taken. Nevertheless, some action at the coming London conference is extremely desirable and would be of direct and immediate advantage to radio-signaling.

RECENT DEVELOPMENTS IN TRANSMISSION-LINE VOLTAGES.

As recently has been described in our pages, the working voltage between any pair of wires in a three-phase transmission line has been raised to the high point of 140,000 volts at the generating end, with a consequent voltage of over 160,000 at or near the distant end of the line. These voltages correspond to approximately 200,000 and 225,000 volts respectively at the maximum point in each alternating-voltage cycle, so that, in this sense, the voltage in transmission lines has approached the quarter-million mark. It is only about fifteen years since 2200 volts was the highest pressure in regular use, if we except a few plants employing 6600 volts. The increase in available line voltage during the last twenty-five years has been astonishing and has greatly changed the limits and possibilities of energy transmission.

The average linear voltage of long-distance transmission in North America is about 750 volts per mile of transmission distance, at which rate the range of transmission with 150,000 volts is 200 miles. But this distance is already exceeded in the West and on one of the Niagara lines, and it is possible to transmit energy commercially at a much lower linear voltage than the average value of 750 volts per mile. It would seem quite feasible to transmit energy regularly to a distance of 500 miles or more with existing machinery and apparatus at 150,000 volts, if it were found economical to do so. The greater the distance to which the energy has to be carried, the greater the share of expense in the transmission line both as to right of way and erection, as well as to subsequent maintenance. It becomes doubtful whether the commercial demand for energy from a given waterfall is likely to call for transmission lines more than 500 miles in length, if we except such abnormal sources as, for example, the Victoria Falls in Africa. As time goes on coal for fuel is naturally likely to rise slowly in cost, and so to increase the radius of economic water-power transmission by electricity; but it seems probable that the demand for energy within a radius of 500 miles from a large source is likely to consume all the energy that can be supplied.

LUNCHEON IN HONOR OF MR. W. D. WEAVER.

As a token of the esteem in which he is held, some of the immediate personal friends and the journalistic associates of Mr. W. D. Weaver gathered at the Engineers' Club, New York, at a luncheon served on April 29, to signalize his retirement from active editorial direction of the *Electrical World*. Mr. James H. McGraw acted as toastmaster. Among the speakers who expressed their sincere appreciation of the honorable editorial career of Mr. Weaver, his advocacy of the best in technical journalism and his helpful constructive influence in electrical engineering development, were his editorial predecessors—Mr. T. C. Martin, now secretary of the National Electric Light Association; Dr. Louis Bell, now consulting electrical engineer, Boston, and Dr. Carl Hering, now consulting engineer, Philadelphia—Mr. B. A. Behrend, consulting electrical engineer, Boston; Mr. J. J. Carty, chief engineer of the American Telephone & Telegraph Company, New York; Mr. John R. Dunlap, editor and publisher of the *Engineering Magazine;* Mr. W. C. L. Eglin, past-president of the National Electric Light Association; Mr. Gano Dunn, president of the American Institute of Electrical Engineers, and Dr. A. S. McAllister, associate editor of the *Electrical World*. As a memento of the occasion the associates of Mr. Weaver in the McGraw Publishing Company presented him with an appropriately engraved watch, chain and fob.

MR. W. D. WEAVER.

The career of Mr. William Dixon Weaver, who with the present issue will retire as active editor of the *Electrical World*, is notable not only because of the self-evident results accomplished through the electrical journals with which he has been identified as editor, but also by reason of many other highly important results attained in his characteristic manner, without widespread public knowledge of his work therefor, but always with the assurance on his part that no credit was withheld from all others assisting in the work.

The engineering training of Mr. Weaver began in 1876, when at the age of nineteen he entered the United States Naval Academy from the Kentucky University, at which he had spent a year in preliminary study. After graduation from the Naval Academy as cadet engineer, four years later, he served in the navy for twelve years, except for one year's leave of absence in 1884, during which he studied electricity and conducted some investigations in the electrical laboratory of the Sorbonne, Paris, and the School of Electrical Engineering, London. In 1883 he accompanied the first Greely relief expedition on the U.S.S. *Yantic*. He was assistant engineer of the navy on the U. S. S. *Omaha*, which made a cruise of the world and spent two years in the waters around China, Japan and Korea. While stationed at the New York Navy Yard he designed an electrical recorder which was largely used in speed trials and at the launching of naval vessels, and also an apparatus with electrical attachments for the calibration of steam-engine indicators. When he resigned from the navy in 1892 he held the relative rank of ensign.

Mr. Weaver acquired experience in the manufacture of electrical apparatus for somewhat more than one year, but could not lay aside his longing for literary work along electrical engineering lines, and hence decided to spend his time in editorial service. His career as electrical engineering editor began in 1893, when he became editor of the original *Electrical World*. In 1896 he enlisted the aid of Mr. James H. McGraw in the foundation of the *American Electrician*, of which Mr. Weaver was the first editor. In 1899, when the *Electrical World* and *Electrical Engineer* were consolidated, he became editor of the combined paper, which position he has held continuously up to the present time, the name of the paper having been changed to the present one of *Electrical World* after the absorption of the *American Electrician* in 1906. An interruption in his editorial service occurred during the Spanish-American war, when he served as volunteer chief engineer on the U. S. S. *Glacier*.

With the results of the labors and leadership of Mr. Weaver in his editorial capacity readers of the *Electrical World* are already familiar. The publications with which he has been identified have been recognized as representing the highest type of technical journalism, characterized by accuracy in presentation, inclusiveness in subjects covered and fairness in matters of discussion. It is to his effective, but little known, labors along kindred lines that attention may well be called in this connection. To him should be given much of the credit for the initial influence which made possible the present Engineering Societies Building in New York and the electrical engineering library which it houses. To him must be credited largely the plans of organization, management and development which resulted in the present highly satisfactory operation of the Illuminating Engineering Society and other societies that have been modeled thereafter. Of this society, as well as the American Electrochemical Society, he was one of the founders. He was appointed a United States government delegate to the Paris International Electrical Congress of 1900, but upon his suggestion the appointment was transferred to another who had taken a more active part in the congress work. To his personal efforts must be attributed much of the success of the International Electrical Congress in 1904, of which he was treasurer and business manager. The successful formation of the Commission on Resuscitation from Electric Shock, composed of representatives of the American Medical Association, the National Electric Light Association and the American Institute of Electrical Engineers, was rendered possible by reason of the untiring efforts of Mr. Weaver.

Although the helpful part he has taken in directing the affairs of many engineering societies with which he has been affiliated has seldom been known widely to the membership of these societies, yet even his retiring disposition has not enabled him to avoid election to office. He served for three years as director of the Illuminating Engineering Society, three years as manager of the American Electrochemical Society, and six years as manager of the American Institute of Electrical Engineers.

Notwithstanding the wide range of Mr. Weaver's activities along the lines of electrical engineering, he found much time to devote to his favorite avocation, bibliography and the collection of publications on the French Revolution. An indication of his interest in bibliography is shown by his supervision of the preparation, editing and publication of the Index to the Wheeler Gift to the American Institute of Electrical Engineers. He possesses one of the largest and most complete collections of books relating to the French Revolution, selected with an intimate knowledge of this period, in which he has been interested for many years. He is a member of several French societies engaged in the study of the French Revolution, and his interest in the subject will doubtless become greater now that he has more time to devote to it.

HONORARY MEMBERSHIP IN THE A. S. M. E. CONFERRED ON DR. RUDOLPH DIESEL.

At a meeting of the American Society of Mechanical Engineers held in the Engineering Societies Building, New York, on April 30, under the auspices of the Gas Power Section, President Alexander C. Humphreys conferred honorary membership in the society upon Dr. Rudolph

Diesel, of Germany, inventor of the Diesel engine. At the conclusion of introductory remarks by Colonel E. D. Meier, past-president of the society, a diploma of honorary membership was formally conferred on Dr. Diesel, who made a brief response. An unusually large and distinguished audience was present to witness the presentation and listen to Dr. Diesel's paper on "The Development of the Diesel Engine," which immediately followed. The paper described the development from the original single-cylinder experimental model, through numerous commercial stages, down to the large multi-cylinder types of over 2500 hp recently built. Applications to stationary and marine practice were dwelt upon, and a very recent locomotive application was mentioned briefly. The paper was extensively illustrated with lantern slides.

PROGRAM OF SEATTLE N. E. L. A. CONVENTION.

Below is given the official program of business to be transacted at the Seattle convention of the National Electric Light Association, June 10, 11, 12 and 13, which will be followed as closely as possible but is subject to certain minor changes. The convention will begin on the evening of Monday, June 10, with a reception and the opening of the exhibition. On account of the large amount of business to be transacted sessions will be conducted in parallel, as many as three being held simultaneously. The sessions will be designated as general, executive, technical, accounting, commercial, transmission, public policy, and company.

GENERAL, EXECUTIVE AND PUBLIC-POLICY SESSIONS.

TUESDAY, JUNE 11, 10 A. M.

(1) Welcome to the city. (2) Address of the president. (3) Announcements. (4) Report of committee on organization of the industry. (5) Report of the secretary. (6) Report of insurance expert. (7) Report of committee on progress. (8) Report of library committee and report of handbook committee. (9) Report on "Question Box." (10) Paper, *Expanded Loyalty*, by Mr. Paul Lüpke.

WEDNESDAY, JUNE 12, 10 A. M.

(1) Report of the rate research committee. (2) Paper, *The Desirability as a Central-Station Load of Pumping for Municipally Owned Water-Works*, by Mr. Charles A. Monroe. (3) Paper, *Educating Central-Station Employees*, by Mr. H. E. Grant.

Executive Session (12 m. or 12:30 p. m.).—(1) Action on report of public policy committee. (2) Presentation of proposed constitutional amendments. (3) Report of the treasurer. (4) Election of nominating committee.

THURSDAY, JUNE 13, 2:30 P. M.

(1) Paper, *Some Uses of Metals*, by Dr. W. R. Whitney. (2) Report of the committee on street lighting. (3) Report of the committee on memorials. (4) Report of the committee on constitutional amendments. (5) Vote on constitutional amendments. (6) Report of nominating committee. (7) Election of officers.

TECHNICAL AND TRANSMISSION SESSIONS.

TUESDAY, JUNE 11, 2:30 P. M.

(1) Report of the meter committee. (2) Paper, *Meter Setting*, by Mr. S. D. Strong. (3) Report of committee on grounding secondaries. (4) Report of lamp committee and report of committee on electrical measurements and values. (5) Paper, *Line Voltage*, by Mr. R. E. Campbell.

TUESDAY, JUNE 11, 8:30 P. M.

(1) Address of the chairman of the transmission committee. (2) Paper, *The Use of Electricity for Irrigation and Agricultural Purposes*, by Mr. C. H. Williams.

WEDNESDAY, JUNE 12, 10 A. M.

(1) Report of the committee on terminology. (2) Paper, *New Energy-Consuming Devices*, by Mr. F. N. Jewett. (3) Paper, *Twenty-four-Hour Service in Small Central Stations*, by Mr. Taliaferro Milton. (4) Report of committee on overhead-line construction.

WEDNESDAY, JUNE 12, 2:30 P. M.

(1) Paper, *Work and Publications of the United States Government Relating to Hydroelectric Development*, by Mr. J. S. Hoyt. (2) Report of transmission committee of the association. (3) Report of committee on transmission progress. (4) Paper, *Switchboard Practice for High-Tension Transmission*, by Mr. Stephen Q. Hayes.

THURSDAY, JUNE 13, 10 A. M.

(1) Report of committee on prime movers. (2) Report of committee on electrical apparatus. (3) Report of committee on underground construction. (4) Paper, *Care and Operation of Transformers*, by Mr. W. M. McConahey.

THURSDAY, JUNE 13, 2:30 P. M.

(1) Report of committee on receiving apparatus for use on transmission lines. (2) Paper, *Corona on High-Tension Lines*, by Mr. G. Faccoli. (3) Report of committee on protection from lightning and other static disturbances. (4) Topical discussions.

ACCOUNTING SESSIONS.

TUESDAY, JUNE 11, 2:30 P. M.

(1) Report of committee on uniform accounting. (2) Paper, *Incandescent Lamp Accounting of the New Edison Company*, by Mr. W. H. Bogart. (3) Paper, *Handling and Accounting for Scrap Materials*, by Mr. Charles E. Bowden. (4) Paper, *General Filing Systems*, by Mr. R. H. Williams.

WEDNESDAY, JUNE 12, 10 A. M.

(1) Paper, *Proper Accounting for the Sale of Electric Devices*, by Mr. L. M. Wallace. (2) Paper, *Scientific Management of an Accounting Department*, by Mr. Franklyn Heydecke. (3) Paper, *Central-Station Motor-Vehicle Costs and Their Distribution to Accounts Benefited*, by Mr. E. C. Scobell.

WEDNESDAY, JUNE 12, 2:30 P. M.

(1) Paper, *Regulated Electric-Light Accounting*, by Mr. H. M. Edwards. (2) Paper, *Progress Made in the Uses of the Tabulating Machine*, by Mr. Schmidt, Jr.

COMMERCIAL SESSIONS.

TUESDAY, JUNE 11, 2:30 P. M.

(1) Address of chairman of section. (2) Address, *Commercial Development of the Electric Industry*, by Mr. W. W. Freeman. (3) Report of committee on membership. (4) Report of committee on steam heating. (5) Report of committee on electric refrigeration and ventilation.

TUESDAY, JUNE 11, 8:30 P. M.

(1) Report of committee on residence business. (2) Report of committee on industrial and commercial lighting. (3) Report of committee on competitive illuminants. (4) Report of committee on electric advertising and decorative street lighting.

WEDNESDAY, JUNE 12, 2:30 P. M.

(1) Report on electric vehicles. (2) Paper, *Electricity in Rural Districts*, by Mr. J. G. Learned. (3) Paper, *A Plan for Increasing Motor Load*, by Mr. H. W. Cope. (4) Report, *Selling Energy to Larger Motor Users*, by Mr. Joseph Lükes.

THURSDAY, JUNE 13, 10 A. M.

(1) Report of committee on cost of commercial department work. (2) Report of committee on contract order routine. (3) Report of committee on the commercial index. (4) Paper, *Ozonators and Their Exploitation by the Central Station*, by Mr. M. O. Troy.

COMPANY SECTION SESSIONS.

THURSDAY, JUNE 13, 3 P. M.

(1) Report of committee on award of Doherty gold medal. (2) Discussion of paper by Mr. H. E. Grant on *Educating Central-Station Employees*. (3) Discussion of the proposed company section lecture bureau. (4) Experience meeting as to company section work.

HEARINGS ON OLDFIELD PATENT BILL.

Hearings on the Oldfield bill to codify, revise and amend the patent laws, which commenced on April 24 before the House committee on patents, have been continued daily.

Mr. Edwin F. Naulty, representing the Fairfax United States Mail Chute System, appeared before the committee on April 25 and made a plea for simplicity in the whole patent system. In response to a question from the committee, Mr. Naulty stated that in his opinion nearly three-fourths of the really valuable inventions are sold outright and the inventor has very little interest in fixing the resale price, it being primarily the manufacturer who wishes to retain this privilege.

Compulsory license or working at any time after four years from the date of issue is rather soon, in Mr. Naulty's opinion, to oblige the owner of a patent to use it or forfeit the exclusiveness of his monopoly. He suggested numerous specific changes in the wording of the bill and closed with a recommendation that patents for improvements upon a prior patent should expire simultaneously with the original fundamental patent.

Mr. H. Ward Leonard, appearing on his own behalf as an inventor and manufacturer and as chairman of the legislative committee of the Inventors' Guild, testified at the hearings on April 24 and 25. Mr. Leonard stated that the patent system was intended primarily for the benefit of the nation and not for the inventors or any other class of persons interested, and claimed that the patent system was not designed primarily to reward inventors. Mr. Leonard stated that it would be a hardship on him if the provision for compulsory license to manufacture an alternative invention or improvement were made. Specifically he stated that the General Electric Company could effectively destroy his business if it should be permitted to obtain licenses under his patents for alternative inventions which he is not at present working and holds for the commercial protection of his prior or original inventions. The right to fix the resale price is not required for the public welfare, but restrictions in reference to the use of the patented machine may be very essential in securing its efficient operation. Nothing can do more to insure future profits to the manufacturer than the efficient functioning of his product, and to this end it is proper to restrict the sale and use of patented articles.

In the interest of the public there should, in Mr. Leonard's opinion, be some means of preventing the unrestricted combinations of patents. He described the patent pool between the General Electric Company and the Westinghouse Electric & Manufacturing Company in 1897, which was not dissolved until April, 1911, at the instance of the Attorney-General. The effect of the pool was that from 1897 to 1911 there was only one market in this country for electric-railway patents. The unlimited combination of patents under one ownership is a grave menace to the public, but in Mr. Leonard's opinion it would be proper to permit a chain of patents relating strictly to one subject or broad invention to pass to a single ownership. In conclusion, Mr. Leonard stated that probably less than 1 per cent of all the inventors are engaged in manufacturing under their own patents. He also stated that less than 1 per cent of the domestic patents issued are ever sold by the patentees; of those that have any substantial value probably nine-tenths are sold outright.

Dr. L. H. Baekeland, of Yonkers, N. Y., was the next witness and appeared in behalf of himself as an inventor. He stated that he could speak from the standpoint of both the rich and the poor inventor who engage in manufacturing under their own patents. After stating that the patent system is primarily for the benefit of the public he went on to say that in his opinion the greatest present need is an easily enforcible patent law. The present system, he stated, is a godsend to corporations, patent lawyers and experts and of very little protection to the inventor. Dr. Baekeland stated that he had kept one of his most successful inventions, namely, velox paper for use in photography, a secret for a number of years and had eventually sold it as a secret process. His advice to inventors is not to waste time and money in obtaining patents unless they have ample means to protect and defend themselves.

Among other things favored by Dr. Baekeland is the publication of applicants' claims for the period of two months, so that anyone interested in any way may file objections with the Patent Office. One of the greatest injustices of the present system is the possibility that a business which has been founded on one or more patents may be practically wiped out of existence by the issuance of a later patent which bears a prior date and has meanwhile been held up, perhaps for years, by interference proceedings. He is in favor of having the term of the patent commence with the date of filing application, except for the time which is lost through involuntary delays in the Patent Office. He mentioned that several interference cases within his knowledge lasted four years, one for more than six years, and another for nine years. These interference cases are drawn out to this length only when both parties have ample capital. Interference cases against weak inventors are quickly settled by compromises or total defeat, because the opposing party lacks the capital to conduct a costly defense. After pointing out a number of specific defects in the bill, he expressed the opinion that certain features of the German law and the United States law if combined would produce an almost ideal patent statute. In Germany the wealthy corporations dare not wilfully infringe a patent, which is in contrast with the policy followed in America.

Mr. Robert E. Shanahan, of Grand Rapids, Mich., appeared before the committee on April 27 in his official capacity as secretary and general manager of the Bissel Carpet Sweeper Company. Like many other concerns which manufacture products for domestic household use, this company distributes its output through jobbing houses and wholesale concerns which in turn distribute to the retail tradesman. For many years the company has maintained a resale price to the ultimate consumer, which has remained substantially constant. Mr. Shanahan stated that the retailer expects to make a profit of from 25 to 35 per cent, the jobber about 15 per cent and the manufacturer from 10 to 15 per cent. He stated that in his estimation the manufacturer in general will make the resale price as low as it can be reasonably fixed, in order to stimulate as much business as possible. He believed this to be of advantage both to the inventor and to the general public. Members of the committee dissented from Mr. Shanahan's view and expressed the opinion that the inventor or patentee ought to have an absolute monopoly, but did not think it to be good public policy to allow the inventor to pass on his monopoly to purchasers of articles manufactured under the patent.

At the hearing on April 29 Mr. Hugh M. Sterling appeared, representing the Association of Registered Patent Attorneys, Washington, D. C., only recently organized. He objected to compulsory license on the ground that it would render the inventor even more helpless against the very large corporations than he is at present. The four-year period of immunity from license is too short, in his opinion, and in one case within his experience an inventor was eight years in getting his invention perfected and into operation. Mr. Sterling also objected to the clause in Section 17 of the bill requiring the patentee of an improvement to grant a license in those cases where the foundamental patent is already licensed, at some prior date.

Mr. Joseph J. O'Brien, of Washington, D. C., patent attorney and inventor, suggested many changes in the bill, some of a radical nature. Among other things he proposed the establishment of a department of knowledge, with a secretary to be appointed by the President and the Senate.

this officer to be also a member of the President's cabinet. The Patent Office would become one of the bureaus in this new department, which also would cover science, art, education, public health and statistics. He also proposed a clause making wilful infringement of a patent a felony punishable by a fine of not less than $3,000 and five years' imprisonment, without prejudice to a civil action for damages. Mr. O'Brien stated that compulsory license is a question needing great study in order not to introduce new abuses. He cited the case of Mr. Patrick B. Delany, the inventor of a very successful and simple system of high-speed telegraphy, capable of handling 1000 words per minute, who tried for years to get it adopted by the large telegraph companies, without result. For a time Delany's system was operated by the Telepost Company, but this concern was not successful. According to Mr. O'Brien, the Delany system was the means, however, of forcing the telegraph companies to adopt the night and day letter scheme. It would be unfair to compel Delany to grant a license, when the established operating companies would not adopt his system. Mr. O'Brien took the general position that the use of the patent monopoly to fix resale prices is not good public policy.

The hearings on April 30 and May 1 were taken up with the arguments of manufacturers against depriving them of the right to fix the resale price on patented articles. Representatives were heard from the Gilette Safety Razor Company, the American Graphophone Company, the Columbia Phonograph Company and the Western Clock Manufacturing Company. Specific instances were cited showing that price-cutting by large department stores or mail order concerns hurts the general sale of patented products on which a fixed retail price is maintained.

TWENTY-FIFTH ANNIVERSARY OF THE COMMONWEALTH EDISON COMPANY.

While the tiresome phrase "Electricity is still in its infancy" is no longer in general circulation, yet the electric-service industry of the country is youthful, after all, for one of its most conspicuous exponents, the Commonwealth Edison Company of Chicago, celebrated its twenty-fifth birthday so recently as April 29, 1912. The April meeting of the Commonwealth Edison Section of the National Electric Light Association marked this anniversary, and Mr. Samuel Insull, president of the company, made a very interesting address.

In a few introductory remarks Mr. Louis A. Ferguson, vice-president of the company, related some facts about the history of the company. Mr. Insull became president of the Chicago Edison Company in 1892 and doubled the capital of the company in the first year, immediately beginning to plan for the erection of the Harrison Street station. The rating of the stations of the company in 1892 was about 5000 hp; to-day this figure has grown to about 400,000 hp. The speaker made the interesting statement that the various companies of which Mr. Insull is chief executive represent an investment of $175,000,000, a gross annual income of $26,000,000 and serve a territory of 12,000 sq. miles.

Mr. Insull said that he had not prepared a set speech, but instead his talk would relate to a number of lantern-slide pictures, among which were one of Mr. Thomas A. Edison and several of historical interest relating to Menlo Park, the old Pearl Street station in New York and the Appleton (Wis.) station, which was the first to be put into actual service, dating back to April, 1882. There were also views of the old Adams Street station in Chicago on the site of the present office building of the company, which was put in operation in 1889 and shut down in 1904. A number of other views were given, one being of the first rotary transformer to be installed in what is now the Twenty-seventh Street substation, which is of interest as being one of the first machines of this kind, if not the first, symbolizing the massing of the production of energy in large generating units, the transmission of this energy to centers of distribution and its delivery to consumers from these centers. Curves were given to show the increase in the company's business, and there were pictures of Fisk Street, Quarry Street and the new Northwest stations. One interesting diagram gave a comparison, drawn to scale, of the 250-kw units at the old Adams Street station, the 3500-kw units at Harrison Street and the 20,000-kw units at the Northwest station.

The speaker devoted much attention to the improvement in the annual load-factor of the company as a result of the policy that has been pursued in securing diversity of business. The load-factor in 1900 was less than 30 per cent; in 1911 it was about 45 per cent. This improvement means that every dollar invested is 50 per cent more productive. It also explains why, with the growth of business, the company is enabled at once to sell electricity cheaper and to make a somewhat better return on the invested capital. A curve was given showing the conservation of coal; that is, the remarkable saving in pounds of coal per kilowatt-hour, with the improvement of the art of central-station design and operation. Other diagrams showed the increase in the amount paid for taxes; the increase in investment, from $797,200 in 1889 to $69,896,000 in 1911; income from lighting and motor service, from $105,700 in 1889 to $13,902,300 in 1911; in number of customers, from 4100 in 1893 to 157,115 in 1911.

Other curves were given representing the requirements of all the electric utilities in Chicago, including isolated plants, to show the benefit from massing production to take advantage of the diversity-factor. Thus, if the steam railroads of Chicago should electrify in the Chicago area it is computed that it would cost them in capital charge $10,000,000 more to make their own electricity in separate plants than to buy electricity from the central-station company, taking advantage of the latter's diversity-factor. If this electrification is brought about, the requirement for electricity would not exceed 200,000 hp.

Charts were given comparing the load-factor of the Commonwealth Edison Company and the New York Edison Company. The maximum demand is about the same in each case, but the Chicago company has a greater output, owing to its better load-curve. A similar comparison results in the case of the load-factors of the Commonwealth Edison Company and the Boston Edison Company. Mr. Insull made the extremely interesting statement that the amount of electricity sold to the consumers by the central-station company in Chicago in 1911 was greater than the corresponding amount sold to consumers by the public electric-service companies of New York, Brooklyn and Boston combined. The generating stations in Chicago are growing at the rate of from 60,000 hp to 80,000 hp per year. Their output is so essential to the industrial life of the community that uninterrupted operation is absolutely necessary. The speaker gave many other interesting facts, as, for instance, that the central-station company consumes 10 per cent of all the soft coal burned in Chicago.

The speaker concluded with a few earnest personal words to the Commonwealth Edison "fellows." He cited the example of Edison, spoke of the enormous amounts of capital going into the business all over the country and said that capital is ever ready to pay for brains. He expressed himself as proud of the fact that he has been able to develop the business in Chicago by utilizing the brains within the organization, and referred to the rise in the company of men like Messrs. Ferguson, Gilchrist, Fox, Gulick and Sargent. The electrical industry is on the threshold of great enterprises; what are wanted, most of all, are men. The president of the company would like to see all the men

in it prosper. "Do all you can for yourselves," he said, "and incidentally you will help us." Twenty-five years from now, if there is a half-century celebration of the company's achievements, some other man may be occupying the position of president, but if the traditions of the organization are carried on it may be that the head of the organization at that time will be somebody who entered the service in this year of 1912.

THE ELECTRIC VEHICLE AT BOSTON.

At the regular weekly meeting of the Electric Vehicle Club of Boston on April 24 Mr. C. D. Marsh, New York, announced that two full pages of electric-vehicle advertising and reading notices would shortly be presented in the various Boston dailies selected for display service. It was stated that a central area in Machinery Hall, in the Mechanics' Building, had been assigned to the club in connection with the Boston 1912 Electric Show. An information bureau in relation to electric vehicles will probably be maintained here, and it is probable that many exhibits in the forms of diagrams and photographs will be assembled for use at that point, supplementing the large display to be made of commercial and pleasure cars. The Massachusetts Institute of Technology is also considering an exhibit of its motor-vehicle research work.

A short discussion of the economies of electric-vehicle routes in city delivery took place. Mr. W. P. Kennedy, New York, consulting transportation engineer of the Boston Edison company, cited a case where a fleet of electrics climbed hills through 90 per cent of the street blocks traversed. A reversal of the delivery routes practically turned the figures around, so that only 10 per cent was spent on hills, with resulting economies of great value to the department store owning the cars. Success had been attained also along the line of inducing women owners of electric pleasure cars to avoid steep grades and take more roundabout routes in ascending hills, little or no loss of time and much economy of battery service resulting. Mr. Kennedy called attention to the efforts of the Electric Vehicle Association of America to collect representative photographs and data bearing upon typical large fleets of electric vehicles and their service. Comparatively few large fleets of gasoline cars are in operation, the economies of the electric machines tending to produce more repeat orders and to build up large groups of electrically driven units. The association is planning to issue a pamphlet of from 50 to 100 pages with reproduced photographs and possibly data illustrating the striking development attained in electric-truck service. Others who spoke briefly were Messrs. A. C. MacIntosh, J. A. Chavanne, M. A. Frank, Dr. Harold Pender and E. S. Mansfield. It is probable that the club will hold a field day at some suburban country club in the early summer, those in attendance being invited to go to the festivities in electric automobiles.

ANNUAL REPORT OF THE DEPARTMENT OF ELECTRICITY OF THE CITY OF CHICAGO.

A résumé of the report of the city electrician of Chicago for the year ended Dec. 31, 1911, recently presented to the City Council, shows that the department is maintaining 12,581 arc lamps (also renting 900 arc lamps and 63 tungsten lamps), maintaining 11,966 mantle gas lamps and 5414 flat-flame gas lamps and renting 8636 gasoline lamps. The average number of municipally operated electric-arc lamps during the year was 12,449. The cash cost per lamp per year is said to be $33.94. The cost, including depreciation, interest and other book charges, is given as $56.52 per lamp. This, of course, is according to the figuring of the department of electricity.

The cost of maintenance of the gas lamps, including all charges, was $18.61 per lamp per year for the mantle lamps, and $15.28 per lamp per year for the flat-flame lamps. The contract cost for maintaining the gasoline lamps was $26.40 per lamp per year.

The total expenditures of the department for street lighting, electrical inspection, gas inspection, fire and police telegraph and telephone service and all other municipal electrical service was $1,288,155, and the revenue earned by the department was $191,345. The number of officials and employees on Dec. 31, 1911, was 397. The total amount expended for construction in the electric street-lighting plant from 1887 up to date has been $4,065,330. The depreciated value of the plant is estimated at $2,566,053.

Under the terms of the city's contract with the Sanitary District of Chicago, there must be installed 3000 flaming-arc lamps by Sept. 30, 1912, and 3000 each year thereafter until the full number of 10,000 is in service. The district had expended on this street-lighting installation up to Dec. 31, 1911, the sum of $390,973.

In the year 1887, when the municipal street-lighting plant was started, the cost per candle-power year was $0.8558. At the end of the year 1911 the cost per candle-power year was asserted to be $0.1619.

During the period from 1903 to 1910 the number of incandescent electric lamps in use in Chicago increased 213 per cent. During the period from 1901 to 1910 the number of fires investigated by the Bureau of Electrical Inspection increased 487 per cent. During the same period the number of fires due to electrical causes decreased 40 per cent.

The fire-alarm office has been moved from its temporary quarters on the third floor at 128 North La Salle Street to the sixth floor of the new city hall, and practically a new equipment has been placed in service. A great many improvements have been made in the office, among which may be mentioned the use of dynamotors instead of batteries and a new map of the city showing the location of engine houses, hook-and-ladder companies, chemical-engine companies, etc., indicated by electric lights controlled by a keyboard placed inside the office. The completed installation is held to make this the best equipped fire-alarm office in the world. The entire installation of this office, including the removal of cables from the old to the new office, cost less than $25,000. The cost of completed fire-alarm office equipment in most of the large cities in the United States has ranged from $50,000 to $80,000. The comparatively low cost and high class of the Chicago office is due to the fact that it was designed by employees of the department who have given this particular branch of the service a lifelong study. A great deal of the apparatus installed in the office was stock telephone and telegraph equipment, and the entire work was performed by members of the department under the supervision of its experts.

THE EMPLOYEE AS AN INVESTOR.

Mr. Henry L. Doherty, of New York, addressed the Luncheon Club branch of the New England Section of the N. E. L. A. at Boston on April 26 upon "The Employee as an Investor," about 300 persons being present. Mr. Doherty delivered a telling argument in support of his views that the wage-earner must become an investor before the present attitude of the public toward utility corporations will be materially improved. America has lagged behind industrially because the public as a whole does not practise economies in expenditures and support widespread individual investments along the lines so successful in France. It can safely be said that the United States needs at least 40 per cent more railroad mileage to-day in order

to handle the business which should be in full tide at the present time, considering the resources of the country. As a nation we are exceedingly extravagant, and it appears easier to make money than to save it. A most important problem is to acquaint the majority of the people with the real purposes of public-utility managers, which are often misunderstood by the individual citizen. Mr. Doherty contrasted the habits of saving on the continent of Europe with those neglected in the United States. He paid a high tribute to the integrity of the administration of President C. L. Edgar of the Boston Edison company, and, in reference to the underlying prosperity of the central-station industry which renders this an attractive field for the investor, the speaker said that about ten times as many steam railroads as electric-light plants go yearly into receivers' hands, and of those that suffer such vicissitudes about 90 per cent of the railroads are carried to receivers' sales as compared with less than 50 per cent of the central stations put under receiver management. In the last forty years the losses in gas bonds have been less than those sustained in national bank deposits.

Closing, Mr. Doherty exhibited a large number of interest tables and diagrams showing the earning powers of money at different rates for extended periods, and he drew the conclusion that the rate of return possible through organized group investments in the central-station industry is so much better than that offered by securities of the governmental type that the future should witness a marked influx of money into the electrical field. Allowing for the effects of quarterly compounding, it should be possible in the near future for groups of people interested in the industry to realize from 6 to 7½ per cent upon their savings. Banking needs to be conducted along more scientific lines, and the tendency to cling to securities giving low returns with maximum safety and flexibility of purchase and sale is being carried too far. Many figures were cited to show that the prosperity of the country should be much greater than the results thus far attained indicate. The great fortunes of America for the most part have been made legitimately by men trusted with the control of other people's funds. Mr. Doherty announced that at no distant date broad arrangements will have been completed to facilitate the more general entrance of small investors into the central-station industry, and said that he proposed to continue his efforts along this line until their success was widely recognized.

BOSTON MEETING OF AMERICAN ELECTROCHEMICAL SOCIETY.

The twenty-first general meeting of the American Electrochemical Society was held in Boston, Mass., from April 18 to April 20. The number of members and guests who registered was 167. It was an unusually interesting meeting. The interest never lagged; all of the sessions were well attended and the discussions which were elicited by the papers were sometimes quite lively. The special prominent feature which will make the convention particularly memorable was the symposium on "electric conductivity" (particularly the application of the electric theory to gases and metals), which lasted through the morning and afternoon sessions of Friday and covered the field pretty thoroughly from many different viewpoints.

At the business meeting on April 18 the result of the election of officers was announced. Dr. W. Lash Miller, of the University of Toronto, is the new president. Messrs. F. A. Lidbury, E. R. Taylor and L. H. Baekeland were elected vice-presidents, and Messrs. E. F. Roeber, L. E. Saunders and L. Kahlenberg managers. Mr. P. G. Salom was re-elected treasurer and Prof. Joseph W. Richards secretary.

The annual report of the board of directors shows the society to be in flourishing condition both as to membership and financial resources. The assets of the society in cash and bonds were $5,865.34 on Jan. 1, 1912, as compared with $4,565.74 on Jan. 1, 1911.

There were a very enjoyable smoker at the Tech Union on the evening of April 18 and a subscription dinner in the Hotel Vendôme on the evening of April 19, while the afternoon of April 18 was devoted to several excursions. One party visited at Worcester the works of the Norton Company, where alundum grinding materials and refractories are manufactured, and the Heroult electric steel furnace at the American Steel & Wire Company works of the United States Steel Corporation. Another party visited the works of the General Electric Company at Lynn.

The sessions of Thursday morning and Friday morning and afternoon were held at the Massachusetts Institute of Technology, that of Saturday morning at Harvard University.

In a subsequent issue will be printed abstracts of the papers and discussions.

PITTSBURGH MEETING OF THE A. I. E. E.

The two hundred and seventy-second meeting of the American Institute of Electrical Engineers was held in Pittsburgh on April 25 to 27, in conjunction with the Association of Iron and Steel Electrical Engineers, and under the auspices of the local section assisted by the industrial power committee of the Institute. The papers, as may be noted from the titles given below, covered topics that pertained largely to mining and the iron and steel industries.

The registration showed a total of 265 members and guests, many of whom were from a distance. Among those present were noted Past-presidents F. B. Crocker, Charles P. Steinmetz and Charles F. Scott, and President Gano Dunn.

The meeting was called to order in the Fort Pitt Hotel, where all the sessions were held, on Thursday morning. The other sessions were held on Thursday afternoon, Friday and Saturday mornings.

On Thursday evening an informal "Dutch dinner" was served at the hotel, Mr. K. C. Randall, chairman of the local section, acting as toastmaster. At the speakers' table were seated Past-presidents Crocker, Steinmetz and Scott, President Dunn, Mr. E. L. Farrar, secretary of the local section, and Mr. B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company.

From the oratorical standpoint, the dinner proved to be a reminiscent meeting, the past-presidents setting the pace in this direction and telling of interesting points in the history of the Institute.

President Dunn made an instructive address on the growth of the Institute and its wonderful influence in promoting co-operation among the manufacturers. He stated in this connection that some years ago he had come to Pittsburgh with a letter of introduction to Mr. George Westinghouse, who received him most courteously but declined to allow him to go through the works owing to the intense feeling then prevalent among manufacturers.

On Friday afternoon the members and guests were taken in a special car, provided through the courtesy of the Pittsburgh Railways Company, to the works of the Carnegie Steel Company at Homestead. After the visit to these mills, the car proceeded to East Pittsburgh, where the plants of the Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company were visited. From East Pittsburgh the vistors were taken back to Pittsburgh through the parks and residential sections of the city in automobiles furnished through the courtesy of the Westinghouse companies.

The meeting ended officially at noon Saturday, and many of the members availed themselves of the opportunity to take in the baseball game between the Pittsburgh and Cincinnati teams.

SELF-STARTING SYNCHRONOUS MOTORS.

In a paper by Mr. Carl J. Fechheimer an analysis was made of the starting characteristics of synchronous motors of the revolving-field, definite-pole type. The author discussed the production of current in the armature in time-phase with, but in space-quadrature to, the revolving field flux, and showed that the phenomena involved in the starting of synchronous motors are similar to those found in the starting of induction motors. Thus, the starting torque expressed in "synchronous kilowatts" is equal to the power input to the rotor under starting conditions. In order to verify this conclusion numerous tests were made. The power input to the stator was measured by means of wattmeters, and the power input to the rotor was determined by subtracting the stator copper loss from the stator input. It was found that in general the average starting torque agrees very well with the power input of the stator, minus the losses in the stator, although there was a marked variation in the starting torque with the different positions of the rotor. In order to secure at starting torque with small current from the line, it is essential with synchronous motors to take account of the same relations found in induction motors; that is, make the losses in the rotor higher by using relatively large resistance, minimize the reactance due to leakage fields which interlink with currents produced in conductors in the rotor at the instant of starting, reduce as much as possible the reactance due to leakage fields in the stator, and make the mmf required to drive the flux across the air-gap as small as is consistent with good performance of the motor under operating conditions. The author expressed the opinion that it is not good practice to sacrifice normal operating performance by reducing the air-gap with a view to improving conditions at starting.

Discussion.

An interesting discussion followed the reading of the paper, participated in by President Dunn and Messrs. H. C. Williamson, F. D. Newbury, H. M. Gassman, A. M. Dudley, W. J. Foster, F. B. Crocker, B. G. Lamme and C. P. Steinmetz. The author was congratulated on his work and the Institute on the receipt of such a paper, President Dunn declaring that some of the deductions of the author were entitled to be known as Fechheimer's laws.

The discussion brought out a number of interesting points. Some speakers preferred to start with the field circuit closed but limited by resistance in the field rheostat. It is much better not to decrease the air-gap to secure better starting conditions. Although the paper was devoted mostly to conditions due to starting, equally interesting phenomena of conditions after the starting period might be discussed. From the operator's point of view there is considerable danger from the voltage induced in the field circuit, which is also an element of danger to switchboard apparatus, even though it may have been designed for high voltage. Some means must be provided to limit the induced potential to a practical value. In placing short-circuiting collars on the poles there is danger of getting too low a resistance at the half-way point. The development of the synchronous motor has really been the adaptation of generators to use as motors.

Mr. Lamme stated that a self-starting synchronous motor is purely an induction motor during the starting period. It has been known for a long time that the synchronous motor is an imperfect induction motor, which could be made more nearly perfect but at an increased expense. It has been known for a long time that the two motors follow the same laws, but the paper is of value in that it shows how these laws are followed by the synchronous motor. The starting torque of the synchronous motor is proportional to the loss in the secondary circuit. An induction motor will run at one-half speed when only a single-phase circuit on the secondary is closed. The nearer the approach to synchronism the easier it is to pull the motor into synchronism.

Prof. F. B. Crocker agreed with Mr. Lamme that there is a great similarity between the synchronous and induction motors, yet there is also a wide difference in many points which present an open field for one motor to combine the advantages of both.

Dr. C. P. Steinmetz said the synchronous motor has decided advantages of operation on an electric system, particularly as to power-factor and voltage regulation, being used to correct the power-factor spoiled by other apparatus, especially on high-tension lines. The motor has no starting torque and the conditions of running and standing still are radically different, the one requiring low resistance and the other high resistance. It would be desirable to design a squirrel-cage winding to change the resistance according to whether the machine is standing still or running.

A short air-gap is advantageous within certain limits, but further decrease results in a loss in starting; the irregularity of starting increases or the uniformity decreases. The minimum torque is what counts in considering the starting conditions. It would therefore be a serious engineering mistake to decrease the air-gap too much.

During the discussion it was brought out that some of the Institute standardization rules do not properly cover the present conditions. President Dunn and Past-president Crocker said that the rules will be revised in time. In regard to this point Dr. Steinmetz remarked that it is useless to complain to the standardization committee unless the complaint is accompanied by definite suggestions as to the change to be made, in which case he and the other members of the committee will be glad to act.

DIRECT-CURRENT AND ALTERNATING-CURRENT MILL MOTORS FOR AUXILIARY DRIVES.

The relative advantages and disadvantages of direct-current and alternating-current motors for auxiliary purposes in rolling mills were outlined in a paper by Mr. Brent Wiley. Descriptions were given of various direct-current and alternating-current motors developed for this purpose. The direct-current motors resemble in many respects the motors employed in street-railway service. The alternating-current motors must be so arranged as to produce a high starting torque with a comparatively low starting current, and the pull-out torque should average about three times the full-load torque. The author predicted a more general use of the alternating-current mill motor, with its many attendant advantages, when its comparative simplicity and reliability become better established.

Discussion.

The discussion was participated in by Messrs. Gano Dunn, A. C. Lanier, M. Whiting, R. Treat and F. Fishback, some of whom disagreed with the author on several points. It was brought out in the discussion that the interpole motor lends itself very nicely to mill-service conditions on account of good commutation. The actual voltage at motor terminals when in service varies with different conditions. A fair value covering average conditions would be about one-half normal voltage, in the opinion of the author. This is not accurate, but a fair average.

The root-mean-square method of working out the various performance data for intermittently used motors is the best one, but produces some discrepancies which it is interesting to know. Its accuracy depends on the shape of the efficiency curve, but no account is taken of the heat absorption capacity of the motors. The adoption of a standard efficiency curve would enable the intelligent discussion of these motors and a factor could be added to cover the absorptive capacity. In this manner motors of different

makes, domestic or foreign, could be compared with great facility. The root-mean-square method suits the average case probably all right, but gives too high a loss at light load and too low at full load.

It was also brought out that there are classes of mill service for which non-commutating-pole motors are suited; for example, on a "screw-down," where simply torque but not horse-power is required, and then light running. In view of recent developments in controllers for protecting motors it might be better in some cases to omit the commutating-pole motors and use a simpler machine.

Based on one-hour operation the question of voltage is not of very material value, the author thinks. He also stated that he did not think any more severe duty would be imposed on the alternating-current control equipment than is placed on the direct-current.

Attention was also called to the fact that a direct-current crane motor will lift until it burns out, which is often preferable to having an induction motor fail on account of overload.

ELECTRIC BRAKING OF INDUCTION MOTORS.

The electric braking of induction motors by alternating current and by direct current was discussed in a paper by Mr. H. C. Specht. Braking by alternating current is effected by reversing the direction of movement of the rotating field. The braking by direct current is accomplished by passing unidirectional current in the primary winding, thereby producing a stationary field, which is cut by the secondary conductors when the rotor is in motion. The braking torque obtained by alternating current braking, even with only half the primary voltage, is as a rule considerably greater than with direct-current braking. With alternating current it is an easy matter to brake the motor with a strong and practically constant torque during the whole period of stopping, whereas with direct-current excitation it is somewhat difficult to obtain good braking torque near stand-still, owing to the rapid decrease in torque from maximum to zero. In cases where infrequent braking is called for braking by alternating current is preferable to braking by direct current. However, where very frequent braking takes place the direct-current method may be preferable on account of the relative saving in energy consumed.

Discussion.

The discussion, which was participated in by Messrs. H. White, H. E. Stratton and C. S. Lankton, brought out the following points: It is impossible to consider the motor alone; it is not a brake, but reverse power, that is being considered, and the emf must be removed from an alternating-current motor when it stops. In steel-mill work it has been found that a very low direct-current potential of only 3 volts or 4 volts is necessary. The controller is often neglected and should be designed in connection with the motor. Dynamic braking often persists after the motor stops owing to the tendency of the current to persist in the circuit, an instance of this kind being cited by Mr. Stratton. President Dunn mentioned what might be called a resonance between the electrically and the mechanically stored energy.

The author stated that a period of thirty-five seconds is sufficiently long for braking almost any kind of equipment.

AUTOMATIC CONTROL OF STEEL PLANT OPERATION.

Mr. Stewart C. Coey presented a paper on "Advantages of Automatic Control in Steel Plant Operation," as exemplified in the plant of the Youngstown (Ohio) Sheet & Tube Company, with particular reference to series-wound accelerating switches. The advantages of automatic control for this class of work seem to be many, but it is not desirable in every case, as it often entails many complications which, because of the class of operators employed, are very objectionable.

In some cases the auto-control is undoubtedly desirable, but in others questionable, and the extra expense is not justified. The series switch is one of the most satisfactory devices ever brought out for automatic-control systems and eliminates a lot of auxiliary contacts. Considerable stress was laid by the author on the controller interlocking device, which, like so many other devices, is all right when it works, but when it does not is useless and in the way. Some operators have removed them entirely, thereby reducing protection on the motor, but they have ample overload capacity and some resistance is left in circuit with the series switch.

From the steel-mill man's point of view the main object is to get out steel and to get it out quickly, and the auto-control assists in this. The simplicity of the master controller gains time for the operator and overcomes time that would otherwise be lost hunting for trouble in unfamiliar apparatus. Overload features are often undesirable, as they delay the mill, and the mill-type motors care for this feature. While the object of the magnetic control is to care for the motor, it should not be allowed to interfere with the operation of the mill. In the opinion of some of the operators, the overload features should be eliminated entirely by the manufacturers.

ELECTRICALLY OPERATED VALVES.

Mr. H. M. Gassman presented a paper outlining the operating conditions to be met and the principles which should govern the design of the electric-motor equipment of the large valves for water and steam connections. The motor can be of either the direct-current or the alternating-current type. The alternating-current motor best adapted for valve operation is one with a squirrel-cage rotor, because of its simplicity. The motor should be designed with a high-resistance secondary in order to obtain large starting torque. For equivalent performance the alternating-current motor should be from 20 to 40 per cent larger than the direct-current motor. For remote control the ideal arrangement is one which permits of automatic starting and stopping of the motor by simply throwing the switch or controller, and one that makes it impossible to start the valve in the wrong direction, thereby wrecking some part of the valve mechanism.

ELECTRICAL EQUIPMENT OF THE REVERSING BLOOMING MILL EQUIPMENT.

Mr. Bradley T. McCormick presented a paper in which was given a brief description of the electrical equipment installed in the reversing mill of the Algoma Steel Company, of Sault Ste. Marie. The mill is designed to roll 75 tons per hour from ingots 20 in. by 20 in. into billets 2 in. by 8 in. in 15 passes. The rolls are driven by two 600-volt direct-current motors mounted on the same shaft, each motor having a normal rating of 2000 hp at 75 r.p.m. The armatures of these motors are connected in series and operated at 1200 volts. Energy for the motors is supplied by a flywheel motor-generator set, consisting of two 1700-kw, 600-volt direct-current generators with their armatures also connected in series, driven by a 25-cycle, three-phase induction motor rated at 1800 hp and designed for 375 r.p.m. synchronous speed. A 150,000-lb. flywheel serves to equalize the load, so that the power drawn from the 25-cycle line is kept practically constant at a value corresponding to the average power required by the rolling-mill motors. The speed control and reversing of the mill motors are effected by varying the voltage impressed upon their armatures through rheostatic control of the field current of the generators. The object in dividing the mill motor equipment into two parts was to minimize the amount of inertia. The motors are of the interpole type and are provided with compensating windings in the pole faces in order to reduce the distorting effect of the armature mmf upon the main field, which would otherwise become quite marked at peak load. The generators supplying energy to

the motors are also of the compensating interpole type. The field circuits of the two generators are joined in series connected across 250-volt exciter mains and controlled by a rheostat of such construction that the exciting current can be reversed and varied by steps over any range between zero and the maximum. In order to permit the flywheel to absorb energy at times of light load and give it out when the load is heavy, use is made of an automatic slip regulator, based on the variation of resistance in the secondary circuit of the induction motor.

Discussion.

The paper provoked an interesting discussion from a number of engineers present, among whom were Messrs. Hall, Reed, Treat, Sykes, Cheney, Specht and Black. From the discussion it was shown that safety is of such great importance that each point should be considered carefully. These particular points were also brought out by the various speakers: The shaft of the motor-generator set is solid and has no couplings. The arrangement of commutators on the motor-generator sets was simply a matter of choice and has not any vital importance. No blowers for ventilation are used on any of the machines. The motors reach full speed on reversal, of 11 revolutions per half minute. The surface speed of the commutators is that common to ordinary motor-generator sets and not excessive. The coils are braced to prevent slipping due to strain of reversal. An output of 70 tons per hour is obtained because this is what is desired, but it is undoubtedly true that 75 tons could be obtained with ease. The overload trips a relay in the armature circuit and opens the exciter-field circuit, which would seem to be sufficient for ordinary protection, but may not be sufficient for sudden overloads, as in the case of a cold ingot in the rolls. An additional relay could easily be added, however. The flywheel of the motor-generator set is in three sections, which is believed to be a good arrangement for this installation because the speed is not excessive for cast steel, and a laminated wheel would be more expensive. A three-piece wheel with reamed bolts is practically as good as one piece where the strains are not excessive, and has the further advantage of ease in handling due to the lighter sections.

It was suggested by Mr. R. A. Black that the end-thrust of the brushes can easily be reduced by cutting a groove in the commutator back of the brush surface so that no shoulder is left, and the author agreed that this might be advisable, although he had never found this necessary.

In regard to questions raised as to the excessive size of the machines and the flywheel, the author stated that the set had been designed on very liberal lines to meet any contingencies, and that the operating companies had requested a 1800-hp motor instead of a 1500-hp machine, as originally intended.

Some of the speakers objected to the use of 1200 volts on account of danger, but it was pointed out that the middle point is grounded and it is impossible to obtain more than 600 volts between any point and ground. The liability to danger is very slight, as the lines are carried only a short distance and in conduits.

The fact that 250 volts had been arbitrarily decided on as standard for steel-mill work on account of safety was also advanced as an argument against the use of the 600-1200-volt equipment. The forced lubrication used is of particular advantage in starting a cold mill after it has been shut down for a day or more.

OPERATION OF ELECTRICALLY DRIVEN REVERSING ROLLING MILL.

Mr. Wilfred Sykes presented a paper in which was given a description of the electrically driven reversing mill of the Illinois Steel Company, South Chicago, Ill. The mill is of the two-high reversing type and was designed for rolling plates of all thicknesses. The rolls proper are driven by two motors mounted on a common shaft, the energy for the motors being supplied through a flywheel motor-generator set. The generator is of the double-commutator type and is connected to the motors without any starting resistance, each motor being connected to one commutator. The motor of the set is a three-phase induction machine. The roll motors are separately excited, the excitation being constant, and the polarity is not changed. The direction of rotation and the speed of the roll motors is controlled by changing the polarity of the generator, varying its field strength and thereby varying the voltage applied to the armatures of the roll motors. In order to equalize the fluctuations of load on the supply system, the motor-generator set is equipped with a 100-ton flywheel. An automatic slip regulator is inserted in the secondary circuit of the induction motor, so that its torque may be adjusted according to the load on the machine. The driving motors have a rating of 2000 hp each, making a total of 4000 hp for the set. The machines are of the commutator-pole, compensated type, compensating windings being embedded in the face of the main poles. The double-commutator generator is also of the commutating-pole compensated type and is designed for a rating of approximately 3000 kw. The motor for driving the generator and flywheel has a rating of 1300 hp. It is a 25-cycle, 6600-volt, eight-pole machine. Although this equipment was built six years ago, it has been found capable of meeting the most severe service it has been called upon to perform. The author remarked that in a new design certain features would be improved upon with the object of simplifying somewhat the equipment from the manufacturing standpoint, but it is not believed that any great improvement could be made from the operating standpoint.

CONTROL OF A MINE HOIST.

Mr. H. W. Cheney presented a paper relating to the constructive details and operating characteristics of an electrical hoist installed in a mine of the Woodward Iron Company, Woodward, Ala. The hoist is of the unbalanced type and consists of a single drum 8 ft. in diameter and 40 in. long, with winding space for 2500 ft. of 1.5-in wire rope. The drum is provided with a band brake, which is automatically applied by weight and released by air pressure under the control of the operator. The drum of the hoist is driven by a 500-hp, three-phase wound-rotor induction motor, through a flexible coupling, triple-reduction gear and an air-operated friction clutch. An important feature of the hoist consists of means for automatically applying the brake in case the supply of energy to the motor fails. For this purpose use is made of an alternating-current solenoid, energized from the supply circuit through a shunt-connected transformer, so arranged that if the solenoid circuit fails the core of the magnet drops and actuates an air valve on the brake cylinder, thus allowing the brake to be set as usual by gravity. The secondary windings of the induction motor are connected to the terminals of a liquid rheostat for varying the resistance of the secondary circuit and controlling the speed of the motor. The liquid rheostat consists of a concrete tank in which stationary plates of cast iron are suspended as electrodes. The electrolyte is raised or lowered in the tank by mechanical means in order to vary the resistance between the electrodes. The electrolyte used consists of ordinary well water in which a small quantity of salt is dissolved. The amount of salt which gives the best results has been found to be 9 lb. per 1000 gal. of water. The liquid rheostat provides an extremely smooth acceleration, so that it is possible to move the rope a foot or two slowly without jerks or sudden impulses. Practical operation has demonstrated that there are very few wrecks inside of a mine employing this form of control, as compared with numerous wrecks in adjacent mines where steam hoists are employed. The author expressed the belief that the liquid rheostat type of control offers possibilities which have not received a due

amount of attention in this country, and that with proper development along this line a highly satisfactory solution is available for the problems encountered in the control of electric mine hoists, especially those employing alternating-current induction-motor drive.

USE OF ALTERNATING CURRENT IN UNLOADING COAL.

In a paper by Messrs. W. N. Ryerson and J. B. Crane full particulars were given of the alternating-current equipments employed in handling coal in the Duluth Superior Harbor. It is estimated that in 1910 40 per cent of the total of 8,300,000 tons of coal received at this harbor was handled by electrical energy. The coal-handling machinery at present installed is divided into three types, bridge tramway, cable car and man trolley. The average yearly load-factor on the bridge tramway system is about 8 per cent, that on the car system is 4.5 per cent and that on the man-trolley system varies from 6 to 12 per cent. The rates charged for energy used for the coal dock service are as follows: $1 per month for each kilowatt of a minimum rating of the load; 1.1 cent per kw-hr. for all energy used up to 70 hw-hr. for each kilowatt of the rating of the load for the month for which the charge is made; 0.5 cent per kw-hr. for all additional energy used. The minimum rating of the load is the maximum rating at which energy is used, as determined by curve-drawing wattmeters. After three years of operation the use of alternating current for this class of service has proved commercially successful, and the author predicted that the majority of new installations upon the harbor will be of the alternating-current type.

PURCHASE OF CENTRAL-STATION ENERGY FOR COAL MINING.

In a paper by Mr. Graham Bright a comparison was made of the relative cost of generating energy locally at the coal mine and purchasing energy transmitted over a distance. The author claimed that the cost of fuel to the coal operator should be based, not upon the price at which coal can be mined, but rather upon the value that could be obtained from the coal if it were sold. He presented statistics tending to show that the only relative disadvantage to the coal operator in purchasing energy from the supply system is the additional capital required for purchasing new apparatus. This disadvantage is offset by many advantages, among which are lower cost of operation, the removal of worry and care of maintaining a generating station, greater reliability, lessened expense involved in discontinuing mining, and the possibility of increasing the output at a small increase in capital.

Discussion.

The paper brought forth an interesting discussion from Messrs. E. D. Dreyfus, H. M. Gassman, W. N. Ryerson, H. N. Muller and W. H. Wood. It was shown that central station service would be advantageous in many cases, regardless of the cost, on account of good voltage, less labor and repairs and increased amount of tonnage. One speaker stated that it would be a better proposition even though it cost twice as much. The line loss often amounts to as much as 40 per cent in mine plants. The central station knows actual costs and its plant is enough larger than the mine plant to take care of peak loads on the latter.

The load is desirable for the central station on account of being maximum in the daytime. The overload possibilities, however, are limited by the size of the transformer installation at the mine, so that nothing is gained in this respect except ability to carry momentary overload. The disadvantages are danger of interruption if only one source of supply is available. In the case of old mines taken over by central stations it is probably better to retain the old machinery as a reserve because its value in that connection is more than on the second-hand market. In the case of new mines it is a question that must be decided on its merits, as the cost will depend entirely on the load-factor and the plant may be as large as the central station. Small mines do not have the engineering talent available in central stations—their business is to mine coal and not to generate energy. Lack of good water for steaming and condensing purposes is another bad feature of mine plants where the coal consumption often runs from 15 to 35 lb. per kw-hr. The consensus of opinion seemed to be that central-station service had many advantages, but each problem must be worked out on its own merits.

IOWA ELECTRICAL ASSOCIATION CONVENTION.

What will probably prove to be the last convention of the Iowa Electrical Association, as such, was that held in Des Moines on April 24 and 25, as at that meeting the association voted in favor of affiliating with the National Electric Light Association. However, as the Iowa Section of the great national organization, the association will look forward, no doubt, to greater benefits and greater opportunities. The association was organized twelve years ago, and it has been one of the most vigorous, self-reliant and useful of the associations. It was an ex-president, Mr. Austin Burt, of Waterloo—a man who has taken a prominent part in the activities of the association—who offered the resolution favoring affiliation. As the committee on the subject, Mr. Burt presented an exhaustive report, in which he gave a history of the geographical section movement in the N. E. L. A. There are now ten geographical sections. The provisions of the N. E. L. A. constitution in relation to membership and dues were explained in considerable detail. There are forty-one Class A members of the N. E. L. A. in Iowa, and nearly all of these are also members of the state association, thus paying double dues. A letter from Secretary T. C. Martin assured the state association that local self-government would be preserved, while the advantages of unity of purpose were pointed out as well as the benefits accruing from the literature and varied services of the national association. The principle of affiliation is a close adaptation of the system of government in this country, said Mr. Martin. The committee recommended that immediate steps be taken to bring about affiliation, and in conclusion Mr. Burt presented a resolution expressing approval of affiliation, directing the executive committee to formulate the necessary changes in the constitution of the Iowa Electrical Association to bring this about, and instructing the president to call a special meeting on ten days' notice to consider the new constitution. This resolution was debated in executive session later, and although there were some expressions of regret at the loss of identity of the Iowa association, there was not a dissenting voice when the vote was taken. The announcement was greeted with applause.

AN UNUSUAL RESPONSE-TO-WELCOME SPEECH.

President H. C. Blackwell, of Davenport, presided at the convention, which was held during the week of the Electric Show at the Coliseum in Des Moines. Some of the sessions were held in the Des Moines Public Library building and some in the Coliseum. The registered attendance was about 250. At the opening session Mr. Mack Olsen, a prominent citizen of Des Moines, gave an address of welcome, his remarks being devoted mainly to a description of the excellent curb lighting of the convention city. The response of Mr. George S. Carson, of Iowa City, was a departure from the flowery and facetious buncombe often dispensed on similar occasions. Instead, Mr. Carson took occasion to refer to matters of public policy. He thanked Mr. Olsen for his welcome, and said that he believed the electric-service companies were entitled to expect a real and sincere welcome in view of what they are trying to do in the upbuilding of their respective communities. Mr. Carson said that he believed the average electric-service company did not have gross annual receipts in excess of one-sixth of the capital invested. The average merchant

takes in six times his investment in the course of a year. This comparison should afford food for thought to the fair-minded outsider who is investigating the question of electric-rate regulation. The speaker expressed himself as in favor of a public-service commission in Iowa. The companies should be allowed such return that they may put out securities offering greater attraction to investors than farm mortgages.

PRESIDENT'S ADDRESS AND SECRETARY'S REPORT.

In his presidential address Mr. Blackwell touched on the importance of the tungsten lamp and the reduction in its price. He spoke of the increasing length of high-tension transmission lines, with the consequent linking up of communities, electrically speaking, and the stimulation of the "electricity on the farm" movement. As applications of electricity increase in number and variety the service companies assume a constantly increasing importance. Illustrating this, the president told of a small company that shut down its plant for an hour in the middle of the day owing to a necessary cut-over and caused a great outcry from a merchant who couldn't open his cash drawer because it was electrically operated by central-station energy. The speaker commented on the growth of operating syndicates as a modern and apparently inevitable tendency. He said that the proposed public-service-commission law in Iowa should be studied carefully.

Secretary A. W. Zahm, of Mason City, reported the accession of seventeen new member companies during the year. President Blackwell took occasion to praise the secretary for his efficient work during the year.

METHODS OF GROUNDING.

Prof. T. A. Fish, of Iowa State College, Ames, presented a continuation report on the investigation of various methods of grounding as carried out at the college at Ames. He gave a table of ground resistances with various kinds of earthing devices. As the result of three years' tests at Ames, ground connections made of copper plates buried in earth now show resistance less than that of galvanized-iron pipe driven in earth. Each plate was about 1 sq. ft. in area and buried 6 ft. below the ground. Higher resistances were found where the plates were embedded in charcoal rather than in plain earth.

Prof. A. H. Ford, of the University of Iowa, Iowa City, said that all ground connections at that place showed lower resistance than last year, owing to the greater dampness. The best results in the Iowa City tests had been obtained with flat cast-iron plates, but plain galvanized pipe driven in the ground is about as effective as anything else.

CENTRAL-STATION "FACTS AND FACTORS."

Mr. Burt presented a very brief report from the "facts and factors" committee. He expressed disappointment at the small number of responses received to requests for data about service conditions. Appeals were made to 148 companies, and only 22 responded. The committee did not feel warranted in drawing conclusions from this limited amount of information. President Blackwell said it was not surprising that the committee was discouraged.

STREET AND CURB LIGHTING STATISTICS.

Mr. A. W. Zahm gave a valuable collection of Iowa street and curb lighting statistics, as chairman of the committee appointed for the purpose. He sent out circular letters, 175 in number, to all the privately owned plants in the State, and received sixty-eight answers, covering nearly all the representative electric-service companies in the State. The following extract from Mr. Zahm's report gives some interesting figures: "The list, as completed to date, shows that there are only thirteen stations in this State operating lamps all night and every night. These thirteen stations receive an average price of $68 per lamp per year, which covers a total of 1972 arc lamps out of a total of 3067 lamps, or nearly two-thirds of the total number. Of the remainder, seven are operating all night on a moonlight schedule and operating a total of 859 lamps, receiving an average price of $69.08 per lamp per year. Two operate until midnight every night, representing a total of eighty-nine lamps and receiving an average price of $54.40 per lamp per year. The remaining thirteen operate on a midnight moonlight schedule, operating a total of 164 lamps and receiving an average price of $63.90 per lamp per year. Twenty-four of the companies from which replies were received have a more or less extensive curb-lighting system. This system of street lighting has become very popular within the last few years and is rapidly replacing the old method of street-intersection lighting along the principal commercial thoroughfares in the larger cities throughout the State. Practically every city having a population of over 5000, and a great many of the smaller cities, including several towns having less than 1000 population, can now boast of 'white way' lighting."

ELECTRIC WATER PUMPING FOR MUNICIPALITIES.

Mr. J. P. Jones, of Cedar Rapids, gave some interesting data, in a committee report, on the use of electrical energy in the State for pumping water for municipal purposes. Twenty-six cases of electric water-works pumping were reported. Of these, seven were municipal plants. However, those who replied to the committee's inquiries did not fill out all the blanks, so that the information was incomplete. The rates received for the energy vary from 1.5 cents to 8 cents per kw-hr. or from 3 cents to 9 cents per 1000 gal. pumped. However, conditions vary so much in respect to head, hours of service, method of payment, etc., that it is difficult to draw conclusions from the figures given, especially as so many of those answering neglected to give essential information. As Mr. Carson pointed out, what is wanted is watt-hours consumption per foot-pound of water pumped. However, as Mr. Blackwell remarked, a valuable start has been made on an important subject. Mr. Rufus E. Lee, of Clarinda, remarked that pumping should be taken on a kilowatt-hour basis. Professor Ford agreed with this and pointed out the fallacy of one rate for the first million gallons and a smaller rate for additional pumping. In summer, when the demand is greatest, the surface in the wells will be lowered correspondingly, and the company may get the lowest rate of pay when it is doing the most work. Mr. Burt and others took part in the discussion. The committee was continued.

DIVERSIFIED DEMAND AND LOAD-FACTOR.

Mr. H. S. Sines, of Chicago, presented in executive session a carefully prepared paper, illustrated by load curves, on "The Effect of Central-Station Rates on New Business." Mr. Sines demonstrated that there are many possibilities of improving central-station load curves if conditions are analyzed as to diversified demand and load-factor.

SUPPLY MEN AS HOSTS.

On the evening of April 24 the affiliated supply men gave a complimentary banquet at the Savery Hotel to the members of the Iowa Electrical Association and the Iowa Street and Interurban Railway Association (the latter holding its convention on April 25, 26 and 27). About 225 electrical men sat down at the tables, and the affair was carried out in excellent style. President Blackwell acted as toastmaster, and there were speeches by Mr. Nathaniel T. Guernsey of Des Moines, Prof. P. G. Holden of Ames and Mr. Woodworth Clum of Davenport. Everybody was pleased with the banquet, and congratulations were extended to the committee in charge, consisting of Messrs. Sam Furst of the Bryan-Marsh Company, J. A. Duncan of the Illinois Electric Company, William Kahl of the General Electric Company and H. E. Mason of the Monarch Electric & Wire Company.

ELECTRICITY FOR FARMERS.

At the morning session of Thursday Mr. H. J. Mauger, of Schenectady, read a statistical paper on "Establishment

of Day Service in Small Towns." He said that 43 per cent of the cities and towns in the United States having electric service have no day service. He advocated more intensive cultivation, electrically, and analyzed reports from a number of small communities. He estimated that out of about 9,000,000 residences in the United States only 1,500,000 are wired. The discussion related, however, almost entirely to the use of central-station electricity by farmers, a subject which Mr. Mauger had touched upon very briefly. Mr. H. W. Garner, of Oskaloosa, asked for information on the subject, as he said that he was receiving requests from farmers for electrical energy. Mr. Mauger said that if the farmer could be induced to use electricity for lighting and domestic appliances as well as for his farm motors his load-factor would be improved sufficiently to make the business profitable.

Mr. Boehner, of Malvern, gave some interesting information about a 9-mile transmission line to which branch lines to farmers' premises are connected. He makes an initial charge of $75 for readiness to serve. The branch lines are from half a mile to three-quarters of a mile long, and the revenue from the farmers ranges from $40 to $60 a year. Mr. Boehner believes that the selling of electricity to farmers under these conditions is satisfactory. The farmers realize that electric motors are better for the operation of farm machinery than are gasoline engines. The farmers are billed on the two-rate method, that is, 15 cents for the primary charge and 6 cents for the secondary charge. Mr. Boehner believes that there is money for the central station in the farmer's business and said that it would be better even to accept a small loss at first than to neglect the great opportunity which is offered.

Other delegates remarked that the problem of protecting the circuits from lightning is the most serious difficulty in the way of supplying electricity to farmers from transmission circuits. There is, of course, the transformer problem to be taken into consideration also. Mr. Blackwell, of Davenport, remarked that it is easy to transform down from 6600 volts to 110-220 volts, and in the case of his company this practice has been adopted as the standard for farm installations. Some farms on branch lines bring in a return warranting a fair expenditure on the part of the company, but, of course, the conditions in relation to each group of prospective customers should be studied carefully. Sometimes the farmers should build their own branch lines. One interesting plan mentioned by Mr. Blackwell is for a group of farmers to form an association which gets the bill for the whole amount of electricity used by all the members of the group. The association then bills its individual members on a meter basis, following much the same plan as is done in curb-lighting associations of merchants in some cities. In the case of the farmers' association, the association makes up the deficiency if any member fails to make his payment for electricity.

Mr. Zahm, of Mason City, told of an enterprising farmer living about a mile from that place. This man paid $600 for line and transformer equipment to bring electricity to him from the company in the city. Telephone poles are used for the wires, and the circuit is operated at 2300 volts. This man uses energy to pump water, operate a cream separator and washing machine and for general-utility purposes. Recently he added a motor to operate a grist mill, and now he is feed-grinding not only for himself, but for his neighbors. The average bill of this farmer is about $20 a month, and he gets enough from the work he does for his neighbors to pay for his own electrical energy.

CENTRAL-STATION HEATING.

After a telegram of greeting had been read from Mr. John F. Gilchrist, of Chicago, president of the National Electric Light Association, two papers were read on central-station heating. The first was by Mr. H. W. Garner, of Oskaloosa, and described the hot-water system in use in that city. The speaker said that there are at present operating in Iowa nine or ten hot-water-heating systems with a connected load of 567,000 sq. ft. The average annual charge is 22 cents per square foot of radiation, with an average cost of coal of $2.37 per ton. The heating service of a central station is as a rule greatly appreciated by customers.

Mr. J. C. Young, of Cedar Rapids, prepared a paper on central-station steam heating which was read by Mr. Metcalf, of the same city. Mr. Young described the construction of the system and also the rates charged in Cedar Rapids, which are based on the water of condensation. He dwelt on the need of good service, and said that among essentials are fair and equitable rates and a management with nerve enough to maintain them.

OIL ENGINES.

Mr. E. O. Brownell, of Lake City, read a short paper on "Oil Engines for Small Central Stations," based principally on an experience of ten months with a single-cylinder low-pressure four-stroke-cycle, 50-hp oil engine in use in his own station. The speaker pointed out the difference between high-pressure and low-pressure oil engines, and remarked on one fact to be borne in mind, that all oil engines are not adapted to use low-priced crude oil as fuel. There seems to be considerable diversity in reports received in relation to the cost of cylinder lubrication in operating oil engines. Experience has shown that the operation of an oil engine is not as simple as is claimed by some of the builders. However, Mr. Brownell concluded his paper with this assertion: "For the small central station, with a twenty-four-hour service, the oil engine is certainly the most efficient and at the same time the simplest and most reliable prime mover offered to us to-day." The speaker remarked later that the oil must not be allowed to become too cold in winter. He was asked in relation to economy of the oil engine on light load, and answered that reports he had received varied from 9 cents to 17 cents as the cost of fuel oil per hour of operation on a 50-hp engine operated at 20 per cent load.

Prof. A. Shane, of Iowa State College, dwelt on the importance of the study of oil engines by small central-station managers, and suggested that a committee be appointed to investigate the subject. Many inquiries have been received at the college in relation to the oil engine. The use of this engine may tend to check the movement to connect small communities to a central source of supply by transmission lines. Mr. Hill indorsed the suggestion. Another member said that he had two engines in use, and their performance was very satisfactory, except that the cost of lubricating oil seemed excessive; also, the cost of operating at light load seemed disproportionately high. Mr. Brownell stated that his oil engine comes up to speed in fifteen minutes after starting.

ELECTRIC-VEHICLE SERVICE.

At Thursday afternoon's session Mr. Blackwell, of Davenport, gave some operating statistics on the use of a 2000-lb. electric truck by the electric-service company in Davenport. With energy at 6 cents a kw-hr. and with wages of operator at $60 a month and depreciation figured at $60 a month, the truck showed in most months a saving to the company, comparing its performance with the ordinary commercial rates for drayage.

WATT-HOUR METERS.

"Requirements of Modern Alternating-Current Watt-Hour Meters" was the title of a paper prepared by Mr. William Bradshaw and Mr. A. W. Copley, of Pittsburgh, and read by Mr. Copley. The paper was an interesting record of the improvement in meters, accompanied by performance curves. The authors remark that the accuracy at present demanded in watt-hour meters is high enough for practical purposes and it is doubtful if requirements

will grow more stringent in this line. It is doubtful, too, if much smaller meters will be obtained, as long as the demand for a high degree of accuracy and also for a low price prevails. A plea was made for the standardization of meters in relation to arbitrary details of construction. In a brief discussion Mr. Blackwell told of a recent inspection of customers' meters in Rock Island and Moline, Ill., and Davenport, Ia., in which 82 per cent of the meters inspected were accurate within 2 per cent plus or minus.

STEAM TURBINES AND CONDENSERS.

Mr. J. B. Wilkinson, of Chicago, read a carefully prepared paper illustrated by lantern-slide pictures, on "Steam Turbines and Condensers." He illustrated turbo-generators ranging from 1 kw to 10,000 kw in rating. He made it clear that small turbo-generator sets are available in any size desired, both for alternating current and direct current, and both condensing and non-condensing above 50 kw. In a new combination turbine illustrated, the impulse and reaction elements are combined in one machine. Several pictures were devoted to the new bleeder type Westinghouse machine, which can be run condensing or non-condensing, and which will perhaps find considerable use in electric generating plants with district-heating systems attached. Low-pressure or exhaust-steam turbines from 100-kw to 10,000-kw sizes were described; also a speed-reduction gear used sometimes to connect high-speed turbines to direct-current generators. Mr. Wilkinson also illustrated a 6500-hp reversing turbine for marine work, capable of being changed from full speed ahead to full speed astern, so far as the machine is concerned, in ten seconds. The Le Blanc condenser was described at some length.

REPRESENTATIVE MOTOR INSTALLATIONS IN IOWA.

Mr. C. T. Reiss, of Davenport, gave an illustrated account of "Representative Motor Installations in Iowa." He spoke of the rapid increase of manufactures in that State, and said that there are about 6000 factories in Iowa, at least 50 per cent of which are equipped with electric drive. From 40 to 100 per cent of all the factories in the principal cities are operated by central-station energy. Ninety-five per cent of all the factories in Waterloo are electrically operated, and Mason City has the proud record of 100 per cent. One interesting point brought out by this speaker was in reference to the electrical operation of rollers in flour mills by direct-connected motors. This practice, he said, which is quite new as yet, represents a distinct advance in flour milling.

CONCLUDING BUSINESS.

In executive session the association adopted a resolution expressing its thanks to the retiring officers, to the supply men for the well-conducted and appreciated banquet and to the Des Moines Electric Company and the Des Moines Electric Show for courtesies extended.

Officers for the ensuing year were elected as follows: President, Mr. Paul B. Sawyer, of Dubuque; vice-president, Mr. A. L. Dodd, of Charles City; secretary, Mr. A. W. Zahm, of Mason City; treasurer, Mr. W. A. Mall, of Belle Plaine; executive committee, Messrs. M. A. Harrison of Nevada, H. W. Garner of Oskaloosa and H. B. Maynard of Waterloo.

It was decided to hold the next annual convention in Waterloo on April 23 and 24, 1913.

THE NEW PRESIDENT.

Mr. Paul B. Sawyer, general manager of the Union Electric Company of Dubuque, president-elect of the association, is one of the youngest men to be chosen for that office. Hs was born in Lafayette, Ind., on May 8, 1879, and has consequently not quite completed his thirty-third year. He graduated from Purdue University in the electrical engineering course in 1900 and took a post-graduate course in electrical engineering at the same institution. He then entered the employ of the Des Moines Electric Company, beginning as timekeeper, and by gradual steps of promotion became assistant superintendent, superintendent and finally general manager, to which position he was appointed in 1907. On Jan. 1, 1912, Mr. Sawyer became general manager of the Union Electric Company of Dubuque, where he has charge of both the street-railway and electric-service interests of the city. He has taken an active interest in the affairs of the Iowa Electrical Association for several years and was vice-president of the association when promoted to the presidency. As president of a geographic section of the National Electric Light Association, he will become a member of the executive committee of that body. Mr. Sawyer is not a man who seeks the limelight of publicity for his individual efforts, but his quiet methods are nevertheless effective, and there is every reason to believe that he will make an excellent executive for the Iowa Electrical Association, or the Iowa Section of the National Electric Light Association, as it will probably become.

PRESIDENT-ELECT PAUL B. SAWYER.

SOUTHWESTERN ELECTRICAL ASSOCIATION CONVENTION.

At San Antonio, Tex., April 25 to 27, a total registration of nearly 300 marked the eighth annual convention of the Southwestern Gas and Electrical Association, whose membership is made up of central-station, electric-railway and gas-plant operators of Texas, Louisiana and New Mexico. To an eloquent address of welcome, delivered by Hon. J. H. Kirkpatrick, of San Antonio, Mr. R. N. Graham, of Houston, responded on behalf of the association in a witty speech.

The official address of President J. E. Carroll, of Beaumont, commented on the increasing growth of the association, which now makes separate parallel sessions advisable, and commended the work done in connection with the question box, program, secretary's office, etc. President Carroll urged more publicity of utility operations through newspaper advertising, educating the public, especially in regard to the increased money values created where private property is reached by utility services. In commenting on state legislation, which, he said, has retarded utility development in Texas, the president expressed less criticism of the lawmakers than of the business interests, which, he observed, have stood back, afraid to let their position be known, fearing that if defeated the result would be worse than ever. In particular, he urged the passage of a law to suppress the activity of damage-suit lawyers, fixing indemnities for cer-

tain injuries and limiting the contingent fees to be collected by the attorneys in such cases. On motion of Mr. E. W. Kellogg, El Paso, a committee comprising Messrs. W. B. Tuttle of San Antonio, David Daly of Houston, R. B. Stichter of Dallas, F. E. Scovill of Laredo and G. S. Clifford of Fort Worth, was appointed to advise upon the suggestions in the president's address.

PREPAYMENT METERS.

"The Prepayment Meter—Its Advantages and Disadvantages" was next discussed by Mr. G. M. Griffith, of Galveston, Tex. Although referring particularly to gas meters, some of the speaker's observations apply equally to coin-operated watt-hour meters. At Galveston, said Mr. Griffith, in spite of discouragement by the company, the use of prepay gas meters is steadily increasing. The effect has been to cut down the consumption per meter by more than 50 per cent, probably owing to the fact that the demand for quarter-pieces serves as a reminder to economy in the use of light. On the other hand, prepay meters for certain doubtful customers, such as small restaurants and saloons, save many troublesome collections and avoid disputes and claims of leaky meters. Prepay meters have also been used to collect delinquent accounts, being set, by understanding with the customer, to register at an increased rate, the difference to be credited to the old account. In a short time the company thus collects the full amount, and the customer is delighted at this easy method of payment. Prepay meters also avoid loss to the company in transferring meter accounts from former to present occupants, as well as in cases where customers move without notice. One of the disadvantages of such meters is the customer's objection sometimes that he does not have 25-cent pieces when needed. Other objections are that these prepay meters cannot be set to sell on a sliding scale; the customer sometimes fails to operate them properly, interrupting his service and causing needless trouble calls; dishonest collectors and thieves can easily rob the meters; counterfeit and foreign coins, slugs, etc., are too often found in the cash boxes, and lastly, the total consumption registered seldom balances with the money in the meter. Most important of these drawbacks, however, is the reduction in consumption which follows their use, the average at Galveston being only 1400 cu. ft. for prepay meters, compared with 3200 cu. ft. for ordinary meters.

Mr. H. M. Moore, Austin, reported that his company operates 2500 prepayment gas meters out of a total of 3300, and finds that these meters permit carrying a large volume of certain classes of business which would be imprudent with ordinary methods of billing and collection. The loss ratio at Austin, he declared, averages less than 0.25 per cent. Mr. H. S. Cooper, Galveston, reported that at Schenectady, N. Y., an ordinance was passed through his efforts making it a felony to tamper with a meter and providing that where only the customer had access to a tampered meter this constituted prima facie evidence of the latter's guilt. In a test case this act was proved constitutional and quickly stopped robbery of prepayment meters. Others who discussed the subject were Messrs. F. M. Lege, Galveston; W. H. Riblet, Houston; E. T. Moore, Dallas; A. G. Curtis, Shreveport; J. F. Storm, Amarillo, and Mr. Dean, of Atlanta, Tex.

CENTRAL-STATION DISTRIBUTION.

"The Distribution of Electricity from the Central Station" was the title of a treatise by Mr. A. D. Brinkerhoff, of Waco, Tex., presenting a useful collection of data and figures quoted from the *Electrical World*, public-service commission reports, A. I. E. E. papers, N. E. L. A. bulletins, etc. Authorities place the cost of generating stations at $80 to $110 per kw of rating, said Mr. Brinkerhoff. Compared with this, in the case of thirty-six Wisconsin cities, the Wisconsin commission has appraised the distribution systems, including meters and transformers, as follows: Cities up to 5000 in population, $66.10 per kw; cities of from 5000 to 12,000, $90.88 per kw; cities of from 12,000 to 25,000, $107.31 per kw; cities of from 25,000 to 50,000, $106.97 per kw; average of all thirty-six plants, $80.44.

The investment in the above plants averaged $55.71 per consumer. For fifteen other plants the investment was $63 per consumer.

Depreciation of a distribution system varies with local conditions and material used. Following are probably the most authoritative figures given out so far: Weather-proof wire (Chicago Consolidated Traction Company), 6.25 per cent; poles, wood in concrete (Wisconsin Railroad Commission), 5 per cent; poles, wood in earth (Wisconsin Railroad Commission), 5.50 to 8.15 per cent; cross-arms (Wisconsin Railroad Commission), 8.5 to 12.5 per cent; transformers, St. Louis Public Service Commission, 6.66 per cent.

The "lost-and-unaccounted-for" in distribution systems is a very considerable item. It amounts to from 15 to 20 per cent in the average alternating-current system. About 14 per cent of this is meter-shunt loss and 50 per cent transformer-core loss. The remainder is divided up between transformer and line copper loss, leakage and energy stolen. The average "unaccounted for" of fifteen cities reporting to the Railroad Commission of Wisconsin for 1911 was 18.09 per cent. Of operating expenses, "distribution" amounts to from 15 to 30 per cent, not including depreciation or allowance for leakage. The average of the member companies reporting on this item was 17.2 per cent.

In outlining systems of distribution, the author also pointed out the advantages of subdividing feeders, due to both flexibility of operation and decreased inductive drop. The "drop" in a number of wires carrying a certain current is materially less than that caused by one wire of equal cross-section. For example, the drop in 2000 ft. of No. 0000 wire carrying 150 amp at 60 cycles is 31.8 volts, whereas the drop in two No. 0 wires (each approximately one-half the cross-section), carrying 75 amp each, would be only 17 volts.

Since underground construction in the business section will probably ultimately be required in any city of considerable size, it is well to locate residence feeders so that they will avoid running through the business district. This will also reduce the risk of damage by fire and consequent interruption in service, which is even more important. Feeders should be carried as near as possible to the electrical center of gravity of the section to be served, before transformers or primary branches are connected to them. This will insure the greatest possible uniformity in voltage throughout the territory served. Each branch feeder and transformer should be controlled by a junction fuse, so that trouble in any particular section will not disturb the other branches nor the main feeder.

Pole lines, of both main and branch feeders, wherever possible, should be run in alleys. This minimizes the possibility of accidents from falling wires, and makes the installation of service wires more convenient and economical. In cities where there are a large number of trees it also keeps the wires clear of grounds and greatly reduces the leakage of the system.

The best practice indicates the use of large-size transformers wherever possible, on account of their lower cost and core loss per kilowatt and the improved diversity factor between a number of individual loads. With large units these savings will usually offset the increased amount of secondary wire required. There are several disadvantages of banking transformers. If the fuse of one blows, its load is added to the other units, lowering the secondary voltage without notification to the central station. Accidents have also happened to linemen ignorant that a blown transformer was banked and its primaries alive through their secondary connection.

Transformer investment, said Mr. Brinkerhoff, generally averages about 15 per cent of the value of the total alternating-current distribution system, including meters, and about 8 per cent of the combined electrical investment. For the fifteen central stations above referred to the transformer capacity averaged 0.606 kw, and the transformer investment $8.90 per consumer. For the same plants the transformer investment equals 14 per cent of the total investment in distribution system, including meters. Above 20 kw to 30 kw in size, said the author in discussion, the cost per kw of transformer is so nearly uniform that it is best to distribute the equipment as smaller units, reducing the cost of secondary copper.

CENTRAL-STATION POWER-FACTOR.

"Relations of Power-Factor to Central-Station Costs" was the subject of a paper prepared by Mr. F. A. White, of Amarillo, and read, in the author's absence, by Mr. G. H. Cushman, of San Antonio. Referring to the effect of power-factor on plant economy and income, Mr. White observed that at 70 per cent power-factor, for example, although 100 amp at 1000 volts may be developed, only 70 kw is being sold. The generator, if a 100-kva machine, is loaded, the transformers and transmission lines are loaded, but only 70 per cent output is being obtained from the plant. Of the numerous plant cost items, said Mr. White, only the relatively small element due to fuel is proportional to kw developed, while by far the major part is dependent on the kva. "We sell kilowatt-hours," wrote the author; "we do not sell kilovolt-ampere-hours, although I sometimes think that is what we ought to sell." The paper included curves showing the effect of power-factor on plant output, machine losses and regulation, and in closing referred to the unity power-factor motor as a means of decreasing the fixed-charge element of production costs.

In the discussion, Mr. E. W. Kellogg, of El Paso, declared that managers have already gone too far to find reasons why rates should vary between different classes of customers, although instead they should be looking for reasons to make rates more uniform. Mr. H. S. Cooper, Galveston, agreed that central-station methods have been unbusinesslike and said that no grocery store would attempt to make a fixed profit on each article sold. Instead, the successful business contents itself with a good average of profit, sacrificing some articles as "leaders." Too long, said Mr. Cooper, has the public been penalized by the central station because electrical energy cannot be stored and for the other disadvantages of electrical supply. Unless the companies are themselves willing to bear these disadvantages of their own business, the public, he predicted, will soon take a hand and insist on more uniform rates.

The Thursday afternoon session closed with a discussion of the railway section of the Question Box, of which Dr. A. C. Scott, Dallas, is editor. Questions and replies were printed in full in the handsome souvenir book and program issued by the association, and comprised chiefly matters of car traffic and operating interest.

LAWS ON THEFT OF ELECTRICITY.

Punishment of theft of utilities was the subject of a paper by Mr. H. L. Geiss, who is an attorney of San Antonio. He first quoted the Texas law, which prescribes $25 to $100 fine as punishment for by-passing a meter, preventing meter's proper operation, tapping wire or main, or using or causing to be used the stolen utility. Other state statistics also punish wilful injury to utility company's equipment, the aiding and abetting in making connections or by-passes, and even the devising of the instrument for such stealing.

Messrs. A. G. Curtis, Shreveport, La., and S. C. Trimble, Orange, Tex., testified to the difficulty of securing convictions under present state laws. Mr. R. C. Brooks, Dallas, said that even setting house meters on street poles does not always put a stop to tampering. On motion of Mr. H. M. Moore, Austin, a committee was appointed to formulate an approved bill on theft of utilities. This committee as appointed by President Carroll comprises Messrs. Geiss, Moore and R. C. Brooks, of Dallas. Mr. W. S. Rathell, Waco, declared that where a combination gas and electric company shuts off either gas or electric service for nonpayment it should have the legal right of excluding both services, although this right is doubted, Mr. Rathell said, by his legal advisers.

CORPORATION RELATIONS WITH THE PUBLIC.

The relations between a utility corporation and the public it serves, said Mr. C. W. Kellogg, Jr., El Paso, constitute the major part of its activities, and include the most fundamental matters touching on its success or failure. Stated in its simplest terms, the relation is a mutual proposition—the public asking and expecting good service at reasonable cost and the company in return expecting fair treatment. This is as simple as the Golden Rule, and is in fact merely an adaptation of that maxim to the case in point. The study, therefore, reduces itself to discussing the ways in which these desiderata may be obtained in practice.

The rapid growth of public-service business, involving many technical problems, has tended to give the technical man the whip hand and to suggest that the mass of technicality which undoubtedly surrounds the public-service business necessitates the highest degree of trained skill for the management of the properties—the obvious inference having been that the beginning and end of the public-service business was embraced in the showing of the Tirrill regulator and percentage of bad debts, not to mention load-factors, demand-factors, diversity-factors and other things which the public could never be able to grasp. This frame of mind had, as much as anything else, to do with the disregard of public opinion which largely prevailed until a few years ago in many public-service corporation managements. In recent years the pendulum has begun to swing back, and sensible managers have come to realize that, while many of the public-service problems are technical and new, the fundamental ones are as old as the hills; and that the same underlying principles govern the sale of transportation, gas and electricity as the sale of food and clothing.

Consider, said Mr. Kellogg, the number of points of contact where there is a chance of friction between the company and the public. Take a medium-sized city with 40,000 inhabitants, 4000 lighting customers and carrying 6,000,000 passengers per year on the street cars. Multiply the number of customers by twenty-five to get the number of times per year their meters are read, bills paid or premises visited. Consider the points of contact involved in those millions of small transactions, and the fact that the attitude and manner of the employee involved in each case are thus representing the attitude of the company almost continuously, and the magnitude of the proposition will be realized, as well as the importance of having each employee accurately and properly represent the company with which he is connected.

Mr. H. M. Moore, Austin, commended the views expressed by Mr. Kellogg, and declared that a copy of his paper should be placed in the hands of every manager in the State. Mr. F. E. Scovill, Laredo, said that the attitude of the manager is always reflected in his employees—"like master, like man." Mr. J. A. Walker, San Angelo, pointed out that the fact that a utility company is a monopoly is reason for it to exercise all possible courtesy and fair-dealing with customers. Mr. J. E. Johnson, Stamford, recommended getting customers a little better acquainted with plant methods of producing the service, its cost and the investment required, by occasional visits to the generating station.

BENEFITS OF ELECTRIC RAILWAYS.

Mr. R. B. Stichter, Dallas, read a paper, entitled "The Benefit of the Interurban Railway to the Community," in which it was stated that in farm country originally worth $50 an acre the interurban railway will create increased land values of $32,000 for each mile of right-of-way, practically equaling its own construction cost, including generating station and equipment. Sale of electrical energy to local industries will increase population and traffic along the right-of-way. The coming of the interurban railway, Mr. Stichter also pointed out, gives country homes to a city class unable to afford extensive town property, while to farm and small-town residents it extends all the conveniences and cultural advantages of the cities. In short, the electric interurban railway "has been a benefactor to all mankind in almost every walk of life."

ELECTION OF OFFICERS.

At the business session of Saturday morning the nominating committee, comprising Messrs. R. B. Stichter, Dallas; W. B. Head, Dallas; H. S. Cooper, Galveston; W. B. Tuttle, San Antonio, and E. W. Kellogg, El Paso, recommended the election of officers as follows, its action receiving the ratification of the convention:

President, Mr. Fred M. Lege, Galveston; first vice-president, Mr. D. G. Fisher, Dallas; second vice-president, Mr. G. H. Clifford, Fort Worth; third vice-president, Mr. W. L. Wood, Texarkana; treasurer, Mr. A. E. Judge, Tyler. Executive committee—Messrs. J. E. Carroll, Beaumont; Fred M. Lege, Galveston; D. G. Fisher, Dallas; G. H. Clifford, Fort Worth; W. L. Wood, Texarkana; A. E. Judge, Tyler; J. W. Carpenter, Corsicana; W. B. Tuttle, San Antonio; David Daly, Houston; F. J. Storm, Amarillo; W. B. Head, Dallas. Finance committee—Messrs. J. P. Griffin, Dallas; P. L. King, San Antonio; H. S. Potter, El Paso. Advisory committee—W. S. Rathell, Waco; E. S. Fletcher, Temple; I. J. Nathan, Marlin; J. E. Johnson, Stamford; E. W. Kellogg, El Paso; William Chaffin, Sherman; W. C. Forbes, Fort Worth; E. J. Wells, Marshall; W. A. Sullivan, Shreveport, La.; R. B. Stichter, Dallas; C. H. Dunbar, Houston. The executive committee selected Mr. H. S. Cooper, Galveston, as secretary. The secretary will devote his whole time to the association in order to compile and distribute engineering data and make the organization most effective.

ENTERTAINMENT.

Visitors to the Southwestern convention found the historic city of San Antonio brilliant in their honor, with nearly 10,000 special colored lamps outlining the principal public buildings, streets and parks, and even studding the historic Alamo, shrine of Texas' liberty. In addition to the recreations of the resort city, an entertainment program arranged by the local committee included automobile rides for the ladies to the famous missions near San Antonio, a reception at the Country Club, an evening theater party, and an al fresco Mexican supper on one of the plazas.

Adjoining the convention hall in the St. Anthony Hotel was an exhibit room where a dozen manufacturers and jobbers occupied booths with displays of interest to convention delegates.

CONSOLIDATION AND REGULATION OF PUBLIC UTILITIES.

At a meeting of the New England Section of the Illuminating Engineering Society at Boston on April 29 addresses upon public-utility regulation were given by Mr. Everett W. Burdett, general counsel of the Boston Edison company, and Mr. W. W. Freeman, vice-president and general manager of the Brooklyn Edison company. Mr. Burdett revealed the fallacies of competition among similar services in a given territory and contended that a regulated monopoly gives much better results from all points of view. He pointed out that competition tends to throw one or more similar services in the same district into the hands of a receiver, after which cut rates have to be given up in favor of the former higher charges. The man in the street pins his faith in many cases to the adage "Competition is the life of trade," whereas intelligent study of utilities shows almost at once that competition in the same field in one locality is an economic waste. The benefits of consolidation with regulation were cited, notably in Boston and Denver, where substantial rate reductions followed the unification of the electric service.

Mr. Freeman emphasized the real but often unappreciated competition which exists in the administration of a public utility such as an electricity supply company through the necessity of meeting the cost of outside service by other illuminants or isolated plants. He said that competition does not permanently lower prices without injury to the quality of the service. The latter is more and more coming to be the important item rather than the price. Continuous service must be had at all costs in a central-station system. Mr. Freeman cited the evils of competition as evidenced in the Kenosha (Wis.) case, where the state commission having jurisdiction refused to permit a rate reduction between two rival plants. Competition tends to increase the disfigurement of streets by multiplied overhead and pole lines, to increase the number of wire troubles and hazards and to postpone the placing of wires below ground. Where different types of distribution service are supplied by competing companies, sooner or later it becomes necessary to duplicate these systems, leading to serious waste in investment and inefficient operation. A regulated monopoly conserves capital and stimulates development along sound channels.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION.

The commission of the Second District has received an application from the Syracuse Utilities Company for permission to reconstruct its steam-heating supply station so as first to utilize the live steam for the generation of electrical energy which will be sold at the switchboard and then dispose of the exhaust steam for heating. It is stated that heretofore no energy, mechanical or electrical, has been generated from the live steam, but this is wholly practicable and only by this means can the plant be successfully operated and the present investment in the property saved. No change, of course, will be necessary in the present heating mains.

A petition has been received from a number of consumers served by the Bath Electric & Gas Light Company, of Bath, Steuben County, complaining as to rates, voltage of supply, condition of the distribution system and street lighting. The petition also asks that the commission cause an inspection to be made of the whole system and the methods of operating.

MASSACHUSETTS COMMISSION.

The Edison Electric Illuminating Company of Boston has petitioned the Gas and Electric Light Commission for authority to purchase the plants and franchises of the Hyde Park Electric Light Company and the Weston Electric Light Company. By the terms of the agreements between the companies, the Edison company is to pay the Hyde Park company $187,000 and to assume the burden of outstanding notes amounting to $28,000, with interest thereon, and the amount of obligations incurred by the Hyde Park company since April 1 for additions to its plant, and to pay the Weston company $112,000 in addition to assuming all obligations incurred by the latter for plant and

property extensions since April 1. Both the smaller companies serve suburban territory adjoining that occupied by the Edison company, and it is expected that substantial economies in operation and marked improvements in service will result from the consolidations. The output of the Hyde Park company is largely devoted to electric-railway applications and will offer a load of desirable characteristics for the Edison system. The Weston company serves semi-rural suburbs of Boston occupied by a large number of wealthy estates, but has been obliged to do business on a small scale. The absorption of the company into the Edison system will standardize the rates and service of the latter throughout a total area of nearly 700 sq. miles.

Subsequent to the filing of petitions with the Gas and Electric Light Commission for authority to purchase the Hyde Park and Weston companies, the Boston Edison company has further petitioned the board for permission to issue not exceeding 26,007 shares of additional capital stock of $100 par value, the proceeds to be devoted to the above purchases and to meet the cost of further additions to the Edison company's plant and system.

The Gas and Electric Light Commission has issued an order approving the issue by the Fitchburg Gas & Electric Light Company at the price of $85 per share of 3274 shares of new capital stock of the par value of $50 each. The proceeds of 2627 shares are for liquidation of obligations and the payment of plant extension costs, and the proceeds of 647 shares are to be applied to the purchase of the plant and property of the Wanoosnoc Power Company, including not less than a 58 per cent interest in the Leominster Reservoir Company. The assets of the Wanoosnoc company comprise a 300-kw hydroelectric plant, dam, water privilege, reservoir interest, penstock and other property used in mill power service, these assets being sold to the Fitchburg company for $55,000. All the energy generated by the Wanoosnoc company has been supplied to a manufacturing company in Fitchburg. The hydroelectric plant in the future will be operated as a part of the Fitchburg company's system. On the latter the Fitchburg company has expended since 1909 over $193,000 upon additions to its plant in excess of stock previously approved, and a further net expenditure of over $91,000 is contemplated to complete the work and provide for further additions.

MARYLAND COMMISSION.

The Maryland Public Service Commission lately granted permission to the Baltimore County Electric Company to take over the properties and business of the Baltimore County Water & Electric Company, paying therefor 3000 shares of its capital stock, of $50 par value per share, and $221,000 par value of forty-year 5 per cent first-mortgage bonds. The authorized bond issue is $1,500,000.

A petition was filed with the commission last week requesting authority for the transfer of the Baltimore Refrigerating & Heating Company's properties to the Terminal Freezing & Heating Company, a corporation formed in August, 1911, with an authorized capital of $1,600,000. This is the outcome of the failure of the Baltimore Refrigerating & Heating Company in 1908. The property was sold by order of the court for $503,000, and in default of payment by the purchaser was resold to a committee headed by Francis T. Homer for $261,000. It is the purpose of the Terminal Freezing & Heating Company to take over the plant and manufacture ice and to furnish heat and cold air to patrons through street mains. The petitioner also requests permission to issue $400,000 par value 5 per cent bonds, dated April 1, 1912, to mature April 1, 1932. John F. Sippel is president of the company.

The Consolidated Gas, Electric Light & Power Company, of Baltimore, was ordered by the commission early in the week to suspend its plans for selling $700,000 par value of common stock until further hearing. This action followed the filing of a statement by Assistant Counsel Albert G. Ritchie in which he told the commission that the Consolidated company is over-capitalized and that the issue of the additional $700,000 of stock might interfere with the reduction of the price of gas and electric energy in the future. At the hearing later in the week the commission reviewed the whole matter and affirmed its order given in the first instance, approving the stock issue. The additional stock is a part of the issue of $1,500,000 of common stock authorized by the commission some time ago, to allow the company to retire $700,000 of prior-lien preferred stock and to make betterments in its property. The company has already issued under this authority $800,000 of stock for retiring the prior-lien preferred stock at 105 and some small short-time loans, and has made all arrangements to dispose of the balance during this week.

Current News and Notes

Chicago Section of Electric Vehicle Association.—At a dinner to be given on May 7 at the Hotel Sherman by the Commonwealth Edison Company Mr. W. H. Blood, Jr., president of the Electric Vehicle Association of America, will inaugurate the Chicago Section of that association. Mr. George Harvey Jones, of the Commonwealth company, is making the arrangements.

* * *

Senate Bill Amending Metal Tariffs.—On April 29 Senator Cummins introduced an amendment to the House bill (H. R. 18,642) which revises Schedule C of the tariff act of Aug. 5, 1909, affecting metals and manufactures thereof. Mr. Cummins' amendment deals with nearly all metals, including aluminum and copper, on which the tariff is reduced. It was ordered to lie on the table and be printed.

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Civil Service Examination.—The United States Civil Service Commission announces an examination on May 22, 1912, to secure eligibles from which to make certification to fill a vacancy in the position of electrician, at $900 per annum, in the Bureau of Standards, Washington, D. C., and vacancies requiring similar qualifications as they may occur. For filling the position in the Bureau of Standards it is desired to secure a competent electrician qualified in the care, maintenance and repair of station storage batteries and skilled in "lead burning" as applied to such batteries. It is also desirable that the appointee shall have had experience as an interior wireman, in addition to having a good general knowledge of electrical work. Announcement No. 350 contains all information regarding the scope of the examination, the vacancy or vacancies to be filled and the qualifications required and can be obtained upon application to the United States Civil Service Commission, Washington, D. C.

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United States Delegates to London Wireless Congress.—The following have been selected as United States delegates to the London wireless conference in June: For the Navy Department—Rear-Admiral John R. Edwards, chairman; Lieutenant-Commander David W. Todd and Dr. Louis W. Astin. For the Department of Commerce and Labor—Mr. John I. Waterbury, New York City; Dr. Arthur G. Webster, professor of physics, Clark University, Worcester, Mass.; Mr. John Hays Hammond, Jr., of New York, graduate of Yale Scientific School, and Mr. William D. Terrell, chief wireless inspector of the Department of Commerce and Labor. For the War Department—Major George I. Squier, Major Edgar Russel and Major Charles McK. Saltzman, all of the Signal Corps. For the Department of Agriculture—Prof. Willis L. Moore, Chief of the Weather Bureau. The United States delegates will advance a proposition to lengthen the radio wave in distress communication.

SUMMER ENGINEERING WORK AT WISCONSIN.—Beginning on June 24 and continuing for six weeks, courses of instruction and laboratory practice will be given at the University of Wisconsin in electrical, hydraulic, steam and gas engineering, mechanical drawing, applied mechanics, testing of materials, machine design, shopwork and surveying.

* * *

NEW YORK EDISON'S SYSTEM FOR CALIBRATING METER-TESTING INSTRUMENTS.—A recent number of the *Edison Weekly*, published by the New York Edison Company, contained a chart 24 in. by 21 in. which shows graphically the system used by the company in standardizing meter-testing instruments, both electrical and horological. The period with which instruments are checked against standards, whether daily, weekly, monthly, semi-annual or annual, is shown on the chart by dotted and broken lines.

* * *

PRACTICAL SAFETY ENGINEERING.—Mr. Henry L. Doherty, president of the Denver Gas & Electric Company, has recently had a thorough study of the gas and electric plants in Denver made by Dr. W. H. Tolman, director of the American Museum of Safety, and by one of the museum's safety inspectors. The instructions were to report all unsafe and unhygienic conditions as well as the best methods for remedying them, with the object of preventing accidents, improving health and incidentally promoting the welfare of the employees, as well as cultivating their loyalty and good will. This report is available for other utilities controlled by the Doherty interests and is an admirable example of work that can be done with evident advantage by every other utility with large plants and employing great numbers of men subjected to industrial hazard.

* * *

COLLEGE WIRELESS STATION.—Students of the State College of Washington, working under the supervision of Prof. H. V. Carpenter, have installed a powerful wireless-telegraph equipment. The increasing demand for this kind of instruction has led the institution to plan a course of a more practical nature than the advanced theoretical course now offered, which will give a good opportunity for students to master the working essentials of wireless methods and to become good operators. An interesting application of wireless telegraphy has just been proposed by the government forest supervisors, who have asked the college for a report on the feasibility of using wireless stations located on high peaks in the forest reserves. Such stations would be much more reliable and easier to maintain than the present forest telephone service and could be installed more quickly and easily.

* * *

OZONE.—At a regular weekly meeting of the Luncheon Club branch of the New England Section of the N. E. L. A., recently held in Boston, Dr. Milton W. Franklin, of Schenectady, N. Y., gave a talk on ozone. About three hundred electrical men were present. Dr. Franklin reviewed the history of ozone researches from the discovery of this highly interesting substance in 1785 to the latest developments for its production on a commercial scale. Since 1894 ozone has been used on a considerable scale in Holland, Russia, Germany and France in the purification of river water. In the United States the first extensive application has been foreshadowed along the lines of improving atmospheric conditions, particularly in connection with the ventilation of auditoriums, hotels, lavatories and clubs. About one part of ozone in a million parts of air is the maximum limit at present desirable on account of physical conditions, or say 1 milligram of ozone per cubic meter of air. The expenditure of 1 kw-hr. will produce 130 grams of ozone in modern equipment, and an ordinary machine for house service should not consume more than 15 watts. The test of desirable quantity is indicated by the sense of smell. In ordinary practice it is important to keep down the amount of ozone present to a quantity which can just be detected by the nose. A field exists for the use of this material in purifying air subjected to the deleterious influences of slaughter houses, factories, glue plants and rendering works. Medical men are investigating the use of ozone as a remedial agent, and the results appear sufficiently attractive to warrant the belief that in skilled hands much good may be secured.

* * *

ELECTRICITY.—In printing the following contribution from Mr. O. N. Frankfort, Anamosa, Ia., we regret that the poetic literary form has to be changed to the prosaic typographical style of a technical journal: "The Mystery.—I am the Swift—I am the Beautiful—I am the Terrible—I envelop the World with My Strength, and men thank God that I am, yet tremble in fear at My Approach. I am old—so old the mind of man cannot conceive numbers sufficient to count the Years of My Being, but still I am the Personification of Youth and Power. For ages and ages I have played through the Heavens, and deep in the Bowels of the Earth I have wrought Mysteries yet unknown to man. I have lit up the Skies with My Presence, and at the deep roaring boom of the thunder I have wrapped whole Forests in Sheets of Fire, smote rocks to fragments, and sent, in panic, the wild beasts rushing through the jungle. I have played 'round the spindling towers man built, leaped o'er the mountains, moved the wild sea, and found My rest in the bodies of people who knew not My Presence. Now man has found Me——. A willing Servant, I fetch and carry, lighting man's home and the streets, speeding his word on the currents of air to far-distant countries, turning the wheels of thousands of mills, driving his cars in the city and doing his toil in the country. Ah! Countless are the things I give in Light, in Heat, in Power, yet even the ones who know Me best know nothing about Me. And though their hands are bold, their hearts are timid. I am the World's Mystery. I am the Terrible, the Beautiful, the Omnipotent. I am ELECTRICITY."

* * *

COPPER-WIRE TABLES.—In a report on copper-wire tables made by the Bureau of Standards it is stated that the American Institute of Electrical Engineers requested the Bureau of Standards to make an investigation on the subjects of copper-wire conductivity and temperature coefficient, which has resulted in the establishment of standard values based on measurements of a large number of representative samples of commercial copper values, which in certain respects are more satisfactory than any preceding standard values. In the investigation it was discovered that the temperature coefficient is proportional to the conductivity. This new law has been corroborated by the Reichsanstalt of Germany and is of considerable importance in electrical measurements. It was also discovered that bending and winding a wire do not change the temperature coefficient, and consequently the internal temperature of electrical machinery may be calculated from resistance measurements with greater confidence than heretofore. A proposal from Germany of a standard conductivity based upon this investigation has been accepted and will probably soon be adopted all over the world. This new standard is a slightly lower conductivity than the former American value and the average of the experimental values published by the Bureau of Standards, but can be considered as substantially representative of average commercial copper. The report gives a history of wire gages, showing that the trend of practice is toward expressing diameters directly in decimal fractions of an inch. The report contains fifteen tables, including complete reference and working tables for annealed copper, both in English and metric units. Tables for copper cables and for hard-drawn aluminum wire are also given. The tables have been adopted as the official wire tables of the American Institute of Electrical Engineers.

Reduction of Electrical Fire Hazard.—The Pittsburgh Boosters' Club has appointed a committee to confer with the Bureau of Electricity and the fire underwriters with a view to improving the conditions of electric wiring in the Pittsburgh district and thereby reducing the fire risks. An effort will also be made to minimize the number of reports of fires incorrectly attributed to defective wiring.

* * *

The Cost of the Hp-Year.—In a paper read by Mr. Raymond L. Foster, engineer of the Fitchburg (Mass.) Yarn Company, at the annual meeting of the National Association of Cotton Manufacturers, in Boston, on April 24, it was claimed that a modern economical steam-power plant in a textile mill using from 1500 hp to 2000 hp can be built for $42 per hp and operated at less than $17 per hp-year.

* * *

Electricity in Mining.—In the annual report of the director of the United States Bureau of Mines for the fiscal year ended June 30, 1911, a description is given of investigations conducted by the bureau relating to the dangers that attend the use of electricity underground and the methods for minimizing and eliminating the danger. The preliminary recommendations of the bureau in regard to regulations concerning the use of electricity in mines have been generally accepted by mining engineers and have been incorporated in the mining law of the largest mining state.

* * *

Great Wireless Station in London.—As a result of the passing by Parliament of the imperial wireless telegraph act it has been decided to build a large wireless telegraph station in West London. At present the Marconi Wireless Telegraph Company is working under considerable disadvantage owing to the fact that its license from the Postmaster-General will not permit wireless messages to be sent overland in England. Arrangements have been completed for a great American station which is to be in direct communication with London. In addition to the New York station, there will be a large station at Cairo, a second at Aden, a third at Bangalore and a fourth at Singapore. From Aden there will be direct aerial communication with Pretoria, in South Africa. When the scheme is complete, which will be within the present year, it is stated it will be possible to send a message to any part of the globe in five minutes.

* * *

SOCIETY MEETINGS.

Philadelphia Section, I. E. S.—At a meeting of the Philadelphia Section of the Illuminating Engineering Society on April 19 Mr. Elias Goldensky presented a paper on *The Applications of Artificial Illumination to Portrait Photography.* The paper was accompanied by demonstrations and by an exhibit of lamps, reflectors, shades, etc

* * *

Philadelphia Section, N. E. L. A.—During April the Electric Company Section of the National Electric Light Association held three meetings, at which papers were presented by Mr. Louis C. Smith on *Photography as Applied to Commercial Purposes,* Mr. Milton V. Simpson on *New Business Campaigns* and Mr. H. L. Doherty on *Thrift, or Making the Wage Earner a Capitalist.*

* * *

Jovian Rejuvenation at Des Moines.—In connection with the conventions of the Iowa Electrical Association and the Iowa Street and Interurban Railway Association the Sons of Jove held a rejuvenation at the Elks' Club, Des Moines, on April 25, at which thirty-five new members were initiated into the order. There was a street parade in the afternoon, and much enthusiasm was manifested.

Colorado Electric Club Reception.—The Colorado Electric Club held a very enjoyable reception in the ballroom of the Brown Palace Hotel, Denver, on the evening of April 25. Ninety couples were present and a fair surplus was realized toward the entertainment fund for the visitors to the National Electric Light Association and the National Electrical Contractors' Association convention in June and July. A special effort is being made to increase the membership to 1000.

* * *

Texas Electrical Contractors' Association.—At a meeting of the State Electrical Contractors' Association of Texas, held at San Antonio April 25, Messrs. W. M. Clower and H. G. Wharton were elected respectively first and second delegates to the coming national convention. The officers of the Texas association, which holds meetings in October and April of each year, are: President, Martin Wright, San Antonio; vice-president, M. L. Hancock, Dallas; secretary-treasurer, E. H. Johnson.

* * *

Iowa Railway Association Convention.—The Iowa Street & Interurban Railway Association held its ninth annual convention in Des Moines on April 25, 26 and 27. Among the papers presented were the following: *Operating Limited Trains on Short Interurban Routes,* by Mr. P. P. Crafts; *Some Experiences with Prepayment Cars,* by Mr. R. A. Leussler; *Gas-Electric Motor Cars,* by Mr. H. G. Chatain; *Experiences of Small Electric Properties,* by Mr. J. P. Walters; *The Use of High-Efficiency Electric Lamps in Street-Railway Service,* by Mr. S. E. Doane, Mr. Doane claimed that even when energy costs not more than 0.5 cent per kw-hr. it is economical to substitute the more expensive high-efficiency tungsten lamps for carbon lamps.

* * *

Cleveland Meeting, A. S. M. E.—The spring meeting of the American Society of Mechanical Engineers will be held in the Hall of the Chamber of Commerce, Cleveland, on May 28-31. Among the papers to be presented will be the following: *A New Analysis of the Cylinder Performance of Reciprocating Engines,* by Mr. J. Paul Clayton; *Problems in Natural Gas Engineering,* by Mr. Thomas R. Weymouth; *The Control of Surges in Water Conduits,* by Prof. W. F. Durand; *Speed Regulation in Hydroelectric Plants,* by Mr. W. F. Uhl; *The Present State of Development of Large Steam Turbines,* by Prof. A. G. Christie; *Thermal Properties of Steam,* by Mr. G. A. Goodenough; *The Cooling Effect of Air and Evaporation on Condenser Water Reservoirs,* by Mr. W. B. Ruggles; *Discharge Capacity of Safety Valves,* by Messrs. E. F. Miller and A. B. Carhart. The secretary of the society is Mr. Calvin W. Rice, 29 West Thirty-ninth Street, New York.

* * *

New York Jovian Luncheon.—The regular semi-monthly luncheon of the New York branch of the Sons of Jove was held at Kalil's Restaurant on May 1. After the cigars were lighted Mr. Charles L. Eidlitz, a well-known electrical contractor of New York, spoke on the topic "What's the Matter with the Business?" His remarks, interspersed with humorous and pertinent anecdotes, were an exceedingly clever satire on the business methods of contractors, supplymen, manufacturers and electric-light companies. The speaker showed with unmistakable logic that many of the present-day methods used in conducting business between and by contractors, supplymen and manufacturers could be greatly improved to the benefit of all concerned. The necessity of guarding against overproduction and lax credit methods and some of the results of price cutting were among the topics discussed. At the close of the address Statesman F. E. Watts called attention to the rejuvenation at Healy's Restaurant, Columbus Avenue and Sixty-sixth Street, on May 17.

NEW HYDROELECTRIC PLANT OF THE SHAWINIGAN WATER & POWER CO.

Second Development at Shawinigan Falls, Quebec, Capable of Generating Electricity Up to 100,000 Hp.

Energy Transmitted at 100,000 Volts Over New Line to Montreal—Complete Segregation of Units and Simplicity of Switching Arrangements—Plans for Minimizing Trouble and Protecting Operators.

By Julian C. Smith and F. T. Kaelin.

DURING last year the Shawinigan Water & Power Company completed its second hydroelectric power development at Shawinigan Falls, with transmission lines and a substation in Montreal. This new power plant is located about 600 ft. from the first power house and is on the banks of the St. Maurice River, near the gorge, above which the St. Maurice River flows over a precipice, giving a difference between upper and lower levels of about 140 ft. This second development furnishes an interesting illustration of the progress made in hydroelectric power developments and transmission during the last ten years, as it embodies the latest improvements in the hydraulic and electric fields.

The St. Maurice River is one of the largest rivers of eastern Canada, having a drainage area of 17,000 sq. miles. The original power development at Shawinigan Falls included the canal, 100 ft. wide, a bulkhead with six penstocks and the power house. In the second development just completed use is made of the same canal, which has been enlarged at the end to a forebay, closed up by the new bulkhead constructed at an angle of about 30 deg. with the old bulkhead and adjoining it.

For improving the water conditions for the new development the water level in the upper bay will be raised about 15 ft. by means of a movable gate dam located across the St. Maurice River, just above the falls. This movable gate dam is at present in course of construction, and consists of twenty stony sluicegates having a clear opening of 40 ft. and a height of 18 ft. These gates will be operated electrically by means of three traveling hoists running on a bridge supported on the concrete piers. Two regulating gates of the same type, 16 ft. wide and 18 ft. high, inclosed in a building and equipped with a heating system, will be provided to regulate excess flow of the river during the cold season.

BULKHEAD AND GATE HOUSE.

The general lay-out of the old and new bulkheads, with penstocks and new power house, is shown in Figs. 1 and 2. The new bulkhead was built with a view to eliminate the troubles which are caused in this northern climate by ice, to procure the best possible construction to maintain an uninterrupted flow of water to the turbines, and to give all the facilities necessary to inspect and repair any part under water, without interfering with other parts of the bulkhead.

The bulkhead is built entirely of reinforced concrete and steel, and provision is made for five 14-ft. penstocks and one 4-ft. penstock to the exciter. The width of the bulkhead at the bottom is 60 ft., the height from the rock to the operating floor 40 ft., and the length of the structure 225 ft. Each unit is complete in itself and independent, straight through from the bulkhead, penstock, turbines, generator, transformer, transmission line and step-down transformer at Montreal.

The water enters the bulkhead under a submerged arch, passes through the front gates, then through the racks and the main penstock gate. Each unit in the bulkhead is separated from the other by a reinforced partition wall, forming with the front gate and main gate of the penstock an independent chamber, of a width of 27 ft. at the entrance, and decreasing in width toward the penstock entrance. These partition walls are 34 ft. high, and are de-

Fig. 1—General View of Hydroelectric Developments of Shawinigan Water & Power Company, Shawinigan Falls, Quebec.

signed to stand the full water pressure when the chamber is empty and the adjacent ones are full. The gates which separate the chamber from the forebay are made in three parts, one above the other, linked together, and are detachable in order to facilitate removal by the traveling crane.

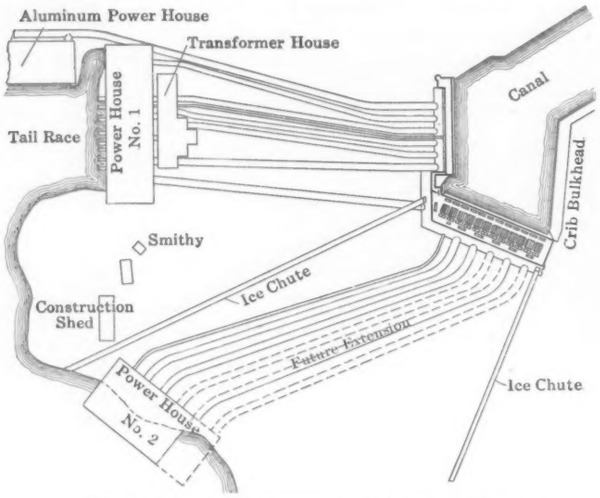


Fig. 2—Plan of Development at Shawinigan Falls.

The racks are constructed at an angle of 60 deg. to the horizontal, are supported by the steel construction incased in concrete, and are designed to stand a pressure equivalent to 80 per cent of the depth of the water. The rack is divided horizontally into two parts, which are linked together and can be lifted out of the water by means of the crane. The rack is composed of bars 3½ in. by 5/16 in., with a clear opening between the bars of 2¼ in. The bars are fastened to a very rigid framework of channels and angles, which construction provides for the safe handling of the racks without any danger of bending or collapse in removing them from the chamber.

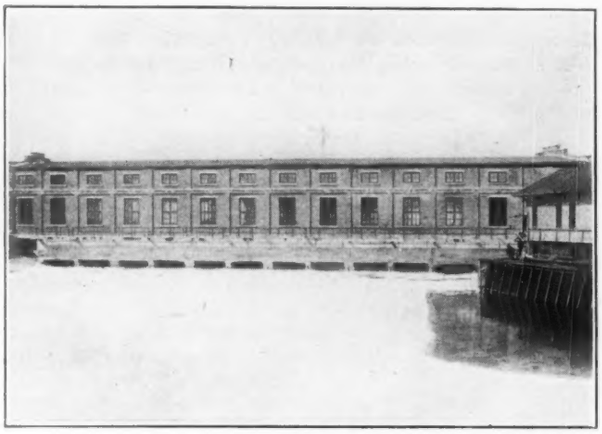


Fig. 4—Forebay Showing New Gate House and Portion of Old Gate House.

The velocity of the water passing into the chambers at the bulkhead is about 2.5 ft. per second. The velocity through the racks is 2.3 ft. and at the penstock entrance 8.5 ft. per second. The concrete walls of the chambers are nicely rounded, and an effort was made to change the velocity of the water as gradually as possible in order to prevent the usual eddies and loss of head which are present in many power developments where care is not taken in this important part of the design.

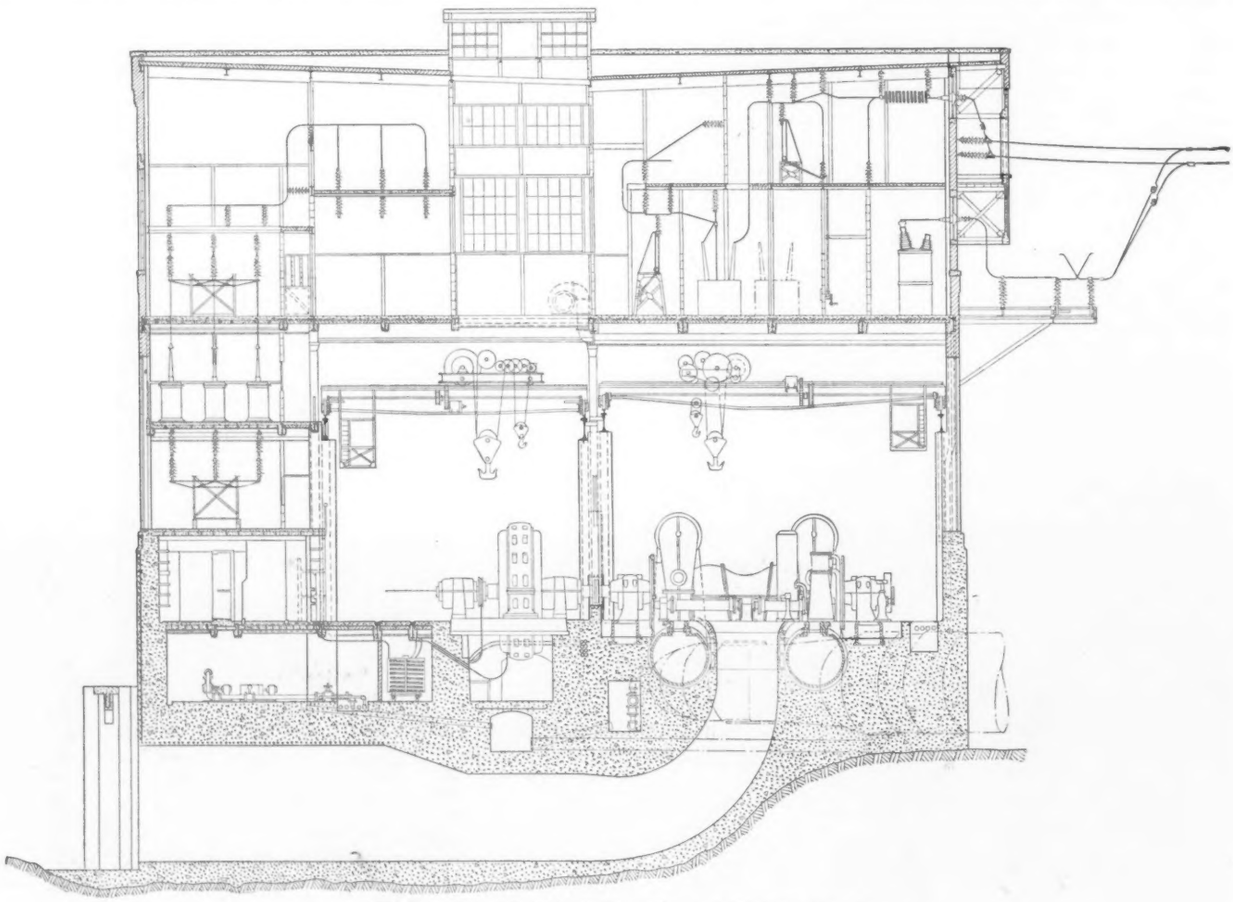


Fig. 3—Cross-Sectional Elevation of Station No. 2.

The main headgate for the penstocks is a steel structure 13 ft. wide and 14½ ft. high, and is raised and lowered by means of a double-screw mechanism operated by bevel gears driven by an electric motor. The motor driving this equipment is of the direct-current series type, operating at

GATE-HOUSE HEATING SYSTEM.

The gate-house building is provided with a 25-ton crane, by which means the front gates, racks and stop logs are manipulated. The design of the heating system of the gate house is somewhat novel. In the construction of the build-

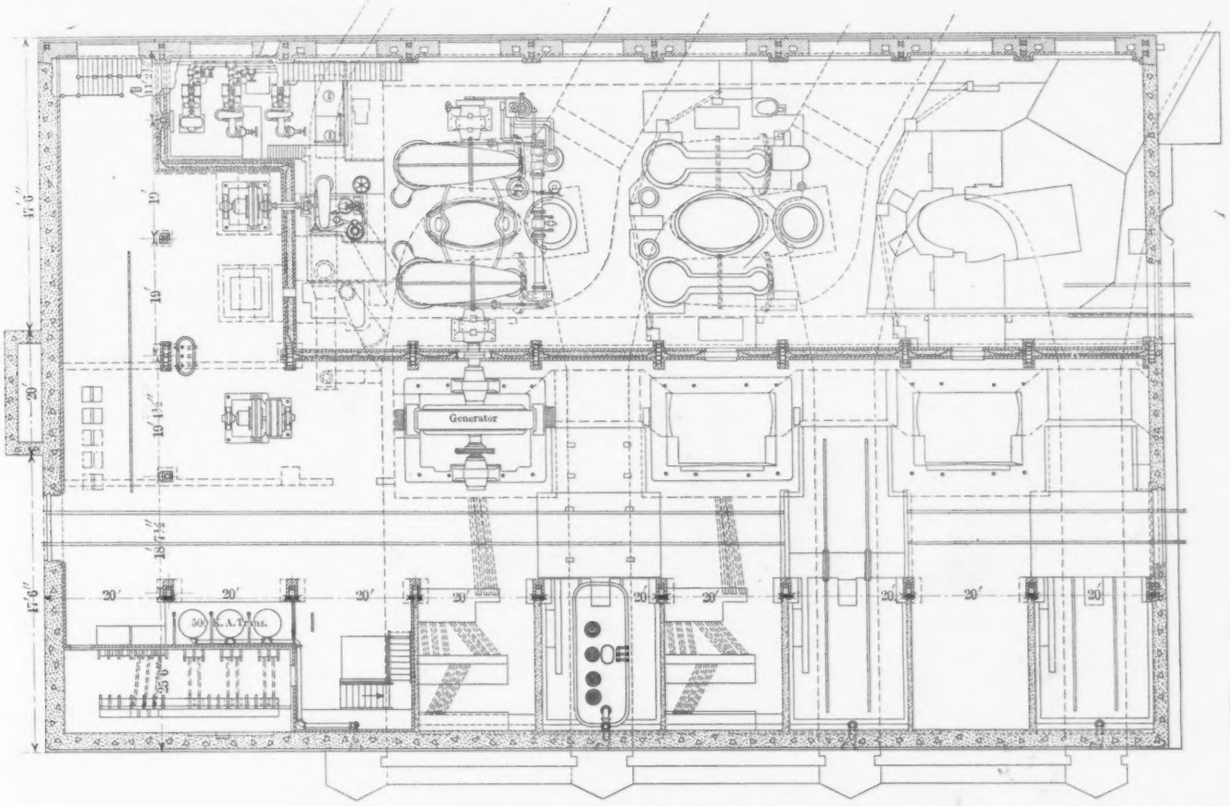


Fig. 5—Plan View of Station No. 2

110 volts and provided with a standard automatic starting equipment. This starting equipment will permit the motor being started either from the gate house or from the power house by means of three buttons. By pressing one of these buttons the motor will be started and the gate raised; by pressing the second button the motor will be stopped, and by pressing the third button the motor will be started in the reverse direction and the gate lowered. Signal lamps are provided, which indicate the position of the gate when it is 1 ft. above the bottom, also the open and closed positions. Limit switches are provided which automatically stop the motor just before the extreme position of the gates is reached.

ing air ducts 12 in. in diameter are provided in the floor and extending the whole length of the gate house, with laterals leading across the building. Openings are provided in the chambers so that air can be discharged in many places throughout the gate house and actually blown down against the steel work in the different chambers.

A large fan is provided in one end of the building, having a capacity of about 60,000 cu. ft. per minute, and driven by a 50-hp motor. The air is taken into this fan through a vertical intake, the air being taken in up toward the top of the room. In this intake are provided electric heaters, which consume about 300 kw. The air coming into the intake is heated by this arrangement, passes through the

Fig. 6—Interior of Gate House.

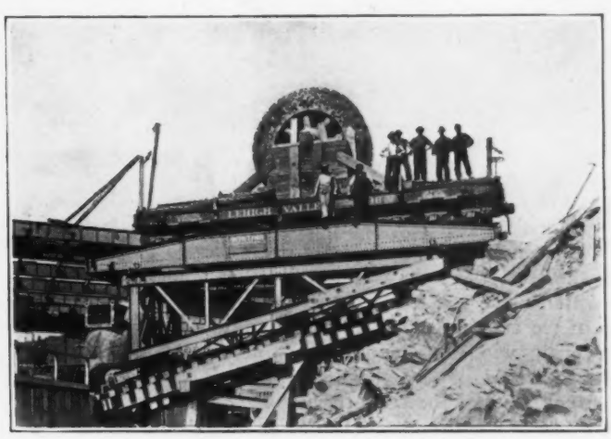


Fig. 7—Skidway Car Taking Rotor Down Hill.

fan at a temperature of about 60 deg. C. and is blown out in many places around the gate house and especially against the top of the racks and the steel work at the side of the gates.

The mean temperature at Shawinigan Falls falls below freezing point usually early in December and, with the exception of occasional thaws, stays below freezing point until the middle of March. The minimum temperatures are reached toward the end of January and beginning of February, when there is usually experienced a continuous temperature of from 10 deg. to 30 deg. below zero for several days. As a result of this, the formation of ice in the St. Maurice River is such that during the course of the winter about 24 in. of ice is formed, and in still, protected places the ice is found much thicker.

In the early days of the power development at Shawinigan Falls it was found that the severe weather caused very great difficulties in the operation of the gates owing to the formation of ice on the gate mechanism, etc., and it was very difficult to get the racks clear owing to the fact that the steel conveyed the heat from the water to the air, and thus the steel was very slightly lower in temperature than the water which was against it. This resulted in the formation of ice and in the sticking of floating ice to the racks, interfering with the operation of the power plant. Experience would indicate that if the steel work above the water could be maintained at a higher temperature than the water the above effects would not be so pronounced. The result of the elaborate heating system which was put in seems to have justified expectations, as there has been no ice formation inside the building and no tendency of the ice in the water to stick to the rack bars. Further, the ice has not formed around the gates, and consequently no difficulty has been experienced in operating the headgates in the most severe weather.

PENSTOCKS.

The penstocks which connect the bulkhead to the power house located on the lower level are 14 ft. in diameter and about 600 ft. long. They are carried in steel saddles placed 12 ft. apart, center to center, the saddles being supported by three concrete piers. The penstocks are made of open-hearth steel sheets varying in thickness from 3/8 in. to 7/8 in. at the power-house end. The 4-ft. diameter penstock is made throughout of 3/8-in. plates. Inside the power house, immediately in front of each water turbine and below the main floor, each penstock ends in two branches, forming the connections to the two cases of the double spiral turbines. The average velocity of the water at full load in the 14-ft penstock is 8.5 ft. per second, and from the data which the writers have the loss in head due to bends and friction in the pipe at full load on the turbine is 1.73 ft.

GENERATING EQUIPMENT.

The lay-out of the plant when completed will be such that there will be five units provided in the power house, but the present building provides room for three units, two being at present installed. Each unit has a normal rated capacity of power delivered from the electric generator of 16,000 hp, giving the station a total capacity of 80,000 hp. This rating is based on a 35-deg. temperature rise of the generator, but provision is made for the generator to operate safely with 45 deg. rise of temperature, and under these conditions to deliver approximately 20 per cent more power, so that in case of emergency the plant can be operated to give about 90,000 hp or 100,000 hp at a power factor of 85 per cent.

The general scheme of the lay-out is to divide the power station in two divisions, each consisting of two units, with the third unit in the center, which is considered as a spare and can be applied in case of trouble to either set of units. The width of the building is 115 ft., length 180 ft., and height from the bottom of foundation to roof is 112 ft.

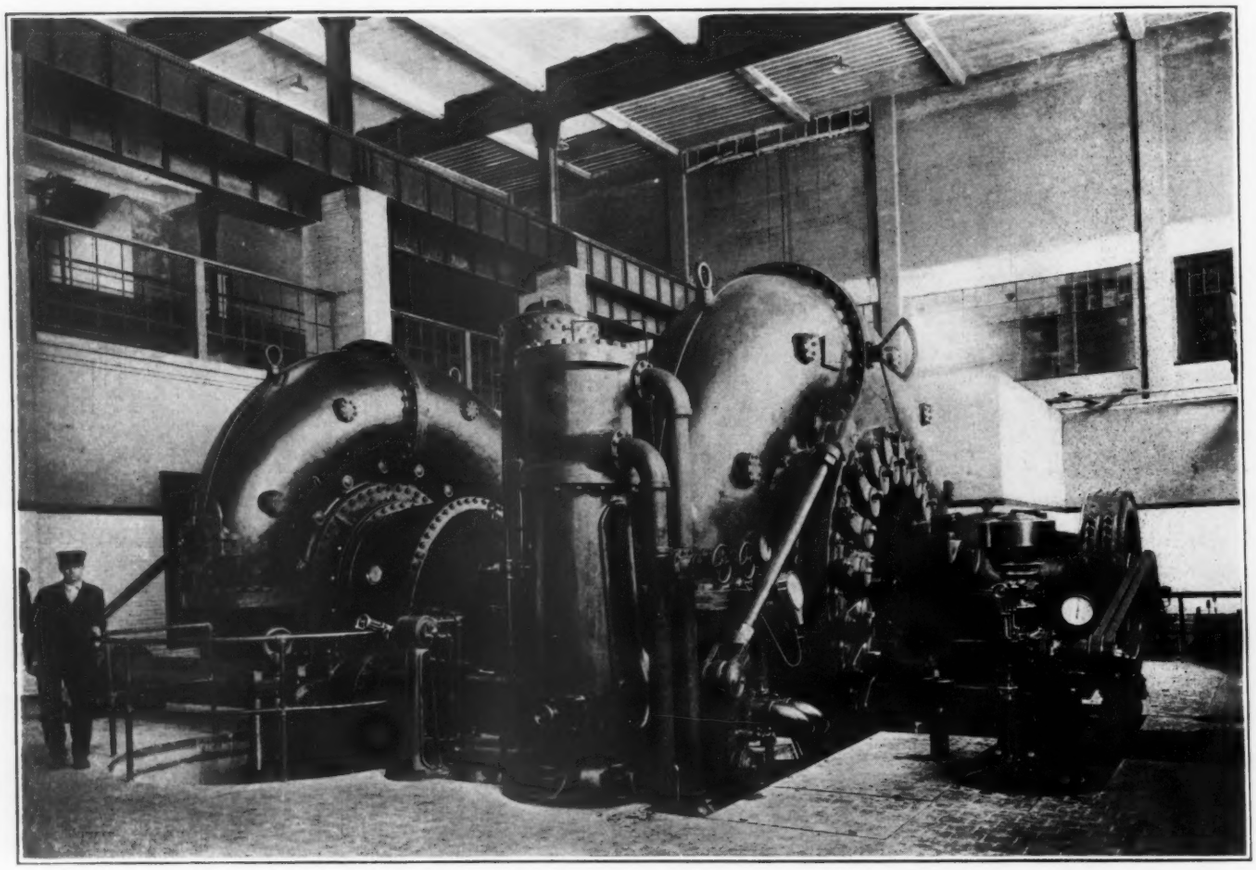


Fig. 8—Main Turbine, Power House No. 2.

The power house is built entirely of reinforced concrete, brick and steel. The walls inside are faced with pressed buff brick, and up from the floor to about 10 ft. with glazed enameled brick. The floor is tiled with English red quarry tiles and conforms with the general interior finish of the power house to give it a neat and bright appearance.

Apart from the generator and turbine rooms, the building contains a complete washroom with shower baths for the men, one bedroom, locker room, office for the superintendent, test room and telephone central station for local and private telephone lines. The machinery rooms are lighted with 400-cp tungsten lamps, fixed directly to the ceiling. All hydraulic machinery is separated from the electrical machinery in the power house by a reinforced-concrete wall 16 ft. high. The units are arranged at right angles to the long axis of the power house and are placed 40 ft. distant, center to center. The generators and turbines each have separate cranes—for the generators one of 100 tons capacity, and for the turbines one of 50 tons capacity. This double arrangement of cranes was of great advantage, as it saved considerable time in the erection of the machinery.

The main turbines are of the twin spiral-case type, receiving the water at the bottom of the case and each case discharging inward to central draft chest. The rating of the turbine is 18,500 hp with an effective head of 145 ft. at 225 r.p.m. The turbines are controlled by movable guide vanes with an outside moving mechanism, operated by the governor engine through a heavy crank shaft and connecting rod. The vanes and runners are made of cast steel. Each turbine is provided with an automatic governor and governor engine, operated by water at 200 lb. pressure. The wheel can also be controlled by hand with water pressure. There is further a device provided to operate the governor engine by a small hand pump. This arrangement is considered in the nature of an emergency apparatus and is not intended to operate the gates quickly.

Each turbine is provided with relief valve located between the two spiral cases below the main floor of the power house and forming a part of the V-shaped penstock connection. The shaft operating the gates of the turbine also operates the relief valve in such a way as to provide a positive movement of this valve, so that the turbine gates cannot close suddenly without opening the valve, and when the relief valve is so opened it will gradually close at such a time as will prevent a rise of pressure in the penstock exceeding 25 per cent of the normal pressure. The relief valve is capable of discharging at least 1000 cu. ft. of water per second, and it discharges directly into the tailrace.

Each turbine is directly coupled to a three-phase, 14,000-kva generator wound for 6600 volts, 60 cycles. The rotating part of the generator weighs 198,000 lb. and the flywheel effect is 4,500,000 lb. at 1-ft. radius. Each generator can be

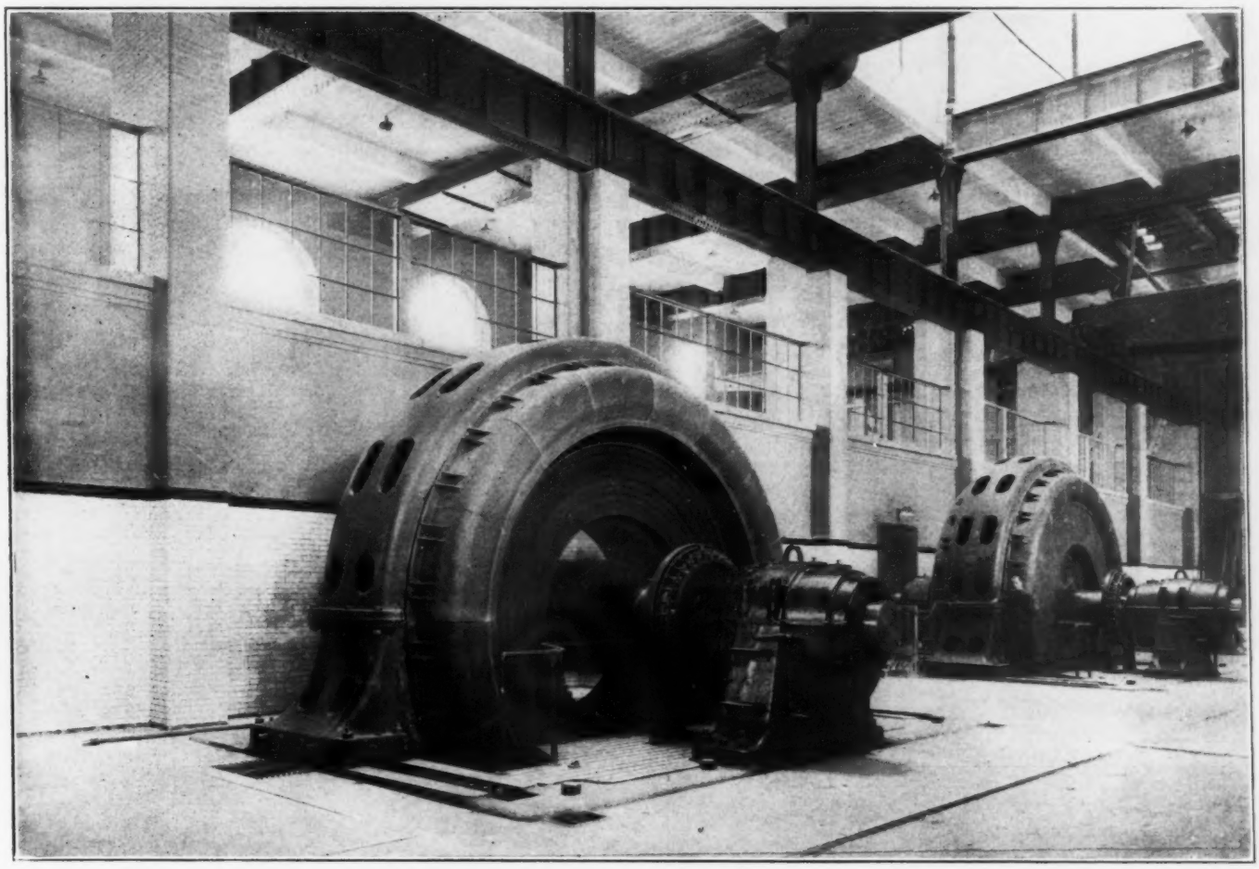


Fig. 9—Main Generators, Power House No. 2.

connected either to a low-tension busbar system or directly to a three-phase, 14,000-kva oil-insulated, water-cooled transformer, which raises the tension from 6600 volts to 100,000 volts.

TRANSFORMERS.

The transformer can be connected on the high-tension side to two busbar systems. The busbar systems are provided with sectionalizing switches, so that each unit with its transformer can be connected directly to its 100,000-volt transmission line.

There are at present two step-up transformers installed in the power house located on the basement floor 11 ft. below the main floor on the tailrace side. By removing the main floor in front of the transformers it is possible to move the transformers out under the cranes of the generator room for inspection or repairs. The outside dimensions of the transformers are 23 ft. x 9 ft., with a height 18 ft. from

the bottom to the top of the high-tension terminals. The weight of the transformer is 260,000 lb. complete. The case contains 10,000 gal. of oil. The cooling water required for the transformer is 56 gal. per minute. The transformers are designed to stand a test voltage of 275,000 volts for one minute between high-tension coil and core. They are

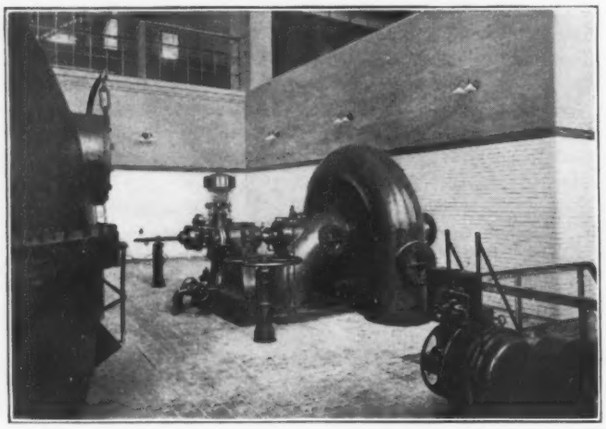


Fig. 10—Exciter Turbine, Power House No. 2.

Y-connected on the high-tension side and delta-connected on the low-tension side, with a neutral connection on the high-tesion side grounded to 100-ohm grid resistor.

In this ground circuit are connected a recording ammeter and a relay to operate the high-tension line switches, should the current in the neutral rise to a dangerous value.

REACTORS.

Between the transformer and generator is connected a reactor coil of twenty-two turns, made up of 2,000,000-circ. mil bare copper cable wound on a hard-wood form. No iron was used in the construction of these coils, all metal parts being of brass. The reactance of this reactor, together with the reactance of the generator, transformer and transmission line, serves to reduce the short-circuit current on the whole system. The combined reactance of the generator, reactor coil and transformer is in the neighborhood of 23 per cent, that is to say, at normal full-load current it consumes 23 per cent of the normal rated voltage.

BUS ARRANGEMENT.

The low-tension busbars with oil switches and disconnecting switches are installed separately for each unit in a con-

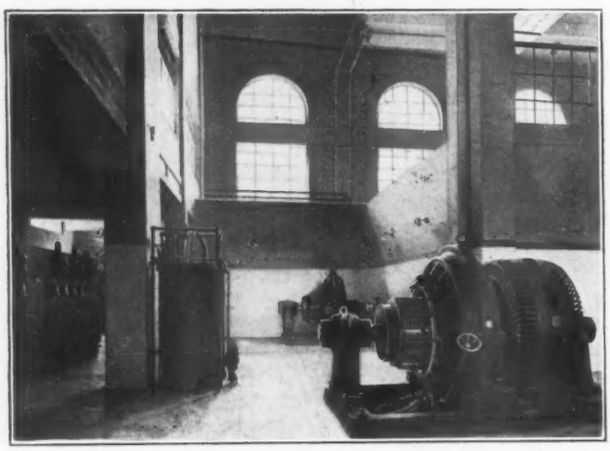


Fig. 11—Motor-Driven Exciter.

crete structure opposite each generator on the main floor, and the cells containing the disconnecting switches and shunts and series transformers are provided with asbestos doors. The high-tension 100,000-volt circuits are made up entirely of 1-in. copper tubing. The high-tension disconnecting switches and oil switches take up the space on the floor above the generator and turbine room.

SAFETY MEASURES.

The whole high-tension wiring is laid out in such a way

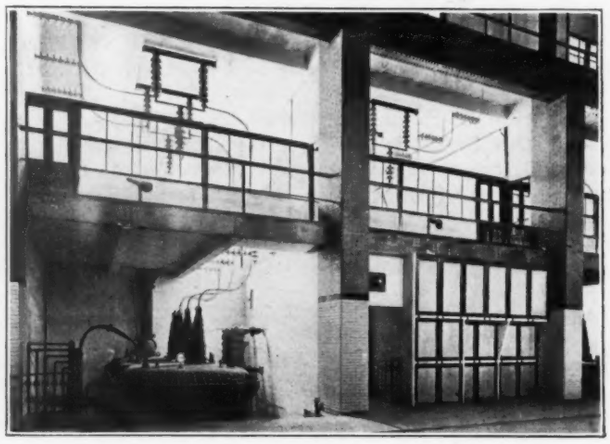


Fig. 12—Low-Tension Switchroom and Main Transformer.

as to afford the greatest safety for the operating force and to eliminate as much as possible mistakes in the operation of disconnecting switches. The high-tension disconnecting

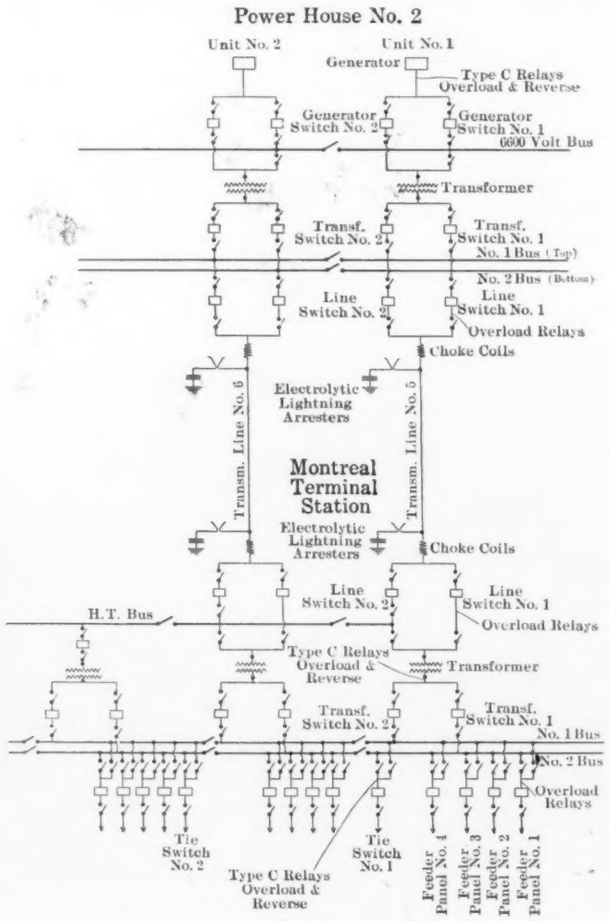


Fig. 13—Circuit Connections of Entire System.

switches form a horizontal bar which bridges a gap of 3 ft. 6 in. of the high-tension circuit. They are operated mechanically, by means of a shaft, gears and chain, from outside of the room where they are located and at a point

remote from any live conductors. Each high-tension oil switch is also located in a separate chamber, and when the disconnecting switches on both sides of such an oil switch are opened the wiring above and around the oil switch is dead and the oil switch can be inspected and dismantled without danger.

Fig. 14—Control Room, Station No. 2.

All disconnecting switches on the high-tension and low-tension busbars are equipped with a telltale lamp system, indicating the "open" and "closed" position of the switches on the benchboard in the switchboard room by small telephone lamps. The "open" and "closed" positions of the oil switches are also indicated by signal lamps at the place where the disconnecting switches belonging to such oil switches are operated. The main switchboard is located on an inclosed gallery at the end of the power house and is of the benchboard type with dummy buses, with indicating instruments on pedestals in front of each benchboard and recording instruments on a panel at the back of the benchboard.

EXCITATION SYSTEM.

Below the switchboard gallery on the main floor are located 125-volt exciter buses and the direct-current switchboard, and in front of it the two exciters, of 400 kw capacity each, one exciter being driven by a 750-hp spiral case turbine and the other by a 440-volt, three-phase motor, provision being made for an additional turbine exciter to be installed. In connection with the exciter system two Tirrill regulators are installed.

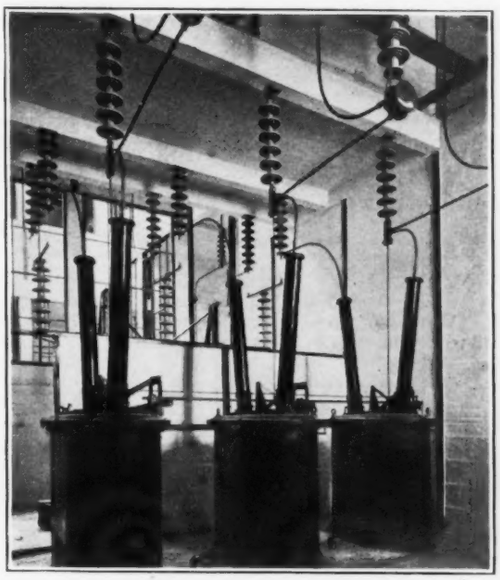


Fig. 15—100,000-Volt Line Circuit-Breaker.

AUXILIARY EQUIPMENT.

All auxiliary motors in the power house are of the direct-current type; alternating current is used only for heating purposes. For cooling the power house in summer a tunnel connecting the generator pits with the outside of the power house is installed and equipped with a fan to blow the air under the generators. The ventilation in the power house is assisted by a ventilating shaft of 18 ft. x 16 ft., just above each generator, which passes through the upper part of the power house through the roof and ends in a skylight. To facilitate communication between the different floors a combined passenger and freight elevator was installed.

Of other auxiliary equipment in the power house, mention might be made of an intercommunicating telephone system, signal system between benchboard and turbine room, compressed air and vacuum system for cleaning purposes, filtering system for pressure water for the governors, oil filter system for the transformer oil, and sterilizing system for drinking water. To take care of any leaks from the turbine or from water in the tailrace, a draining system in the basement of the power house with a 100-hp motor-driven and a 100-hp water-driven centrifugal pump is installed.

An interesting problem which came up in connection with the construction of the power house was the handling of the steel work and machinery—in fact, everything in the power house—from the railway siding to the power house. The power house is located at an elevation about 130 ft. below elevation of the siding and about 600 ft. distant. An inclined railway between the railway siding and power house was built and equipped with a special inclined car, combined with a turntable on the top. The freight cars were run from the siding directly on this inclined car and lowered down hill by means of a steel cable operated by an electric motor. After the inclined car arrived at the lowered position the freight car was turned around by means of the turntable and pulled in the power house under the cranes for unloading.

This arrangement worked very satisfactorily and proved a great economy of time and labor.

RAPIDITY OF ERECTION.

The cofferdam for the new power house was started in September, 1910, and the excavation and steel work for the foundation were carried along during the following winter. At the time of the spring flood the concrete work was well above the water, that is, about 40 ft. above the rock foundation, so that the work was not interrupted. By the middle of June two cranes were erected and in operation, and on Sept. 1, 1911, the first unit, consisting of turbine and generator, was erected ready to run. The commercial operation of the power house was started Nov. 13, 1911.

Fig. 16—Switchboard Room and Oil Switches.

REMOVABLE-PANEL SWITCHBOARD AND INSTRUMENT COLUMNS.

Description of Switchboards Designed for Facilitating Repair Work and of Individual Generator and Motor Switch Columns.

By Warren H. Miller.

IN the central electricity supply station of great industrial works the absolute necessity for keeping the various departments in operation at any hazard is a phase of the energy-furnishing problem which is receiving more and more study devoted to the practical design of switchboards and equipment capable of handling all of the emergencies that may arise. The necessity for some radical improvement in the switchboard controlling the apparatus for large works has long been appreciated and the largest electric manufacturing companies have put out equipment aimed to meet industrial needs. The advances made by the German engineers along the same lines have been most bold and successful and they should be known to every American engineer. The introduction of the electrically operated oil switch opened up new possibilities for improvement in switchboard design, particularly for generating stations of large factories, and the German engineers seem to have worked out these possibilities in a very logical manner. In brief, this switch paved the way for interchangeable removable switchboard panels, followed by the special truck or frame on wheels containing a complete reserve panel always at hand for emergency. The truck can be run up onto the platform, the defective panel removed and a new one locked into place without requiring more than a few minutes' stoppage of the supply of energy for any particular department. The defective panel can then be rolled off to the electrical repair department and the repairing properly done on it without any danger to the electricians. Factory electrical engineers will appreciate this feature, particularly for high voltages.

The removable panelboard has reached its highest development in the big gas-engine-driven electric central stations of the Westphalian steel mills. Here the enormous and violently fluctuating loads are particularly severe on the switchboard equipment, and a damaged panel cannot be spared for any great length of time.

The accompanying illustrations show a typical panel on the wheeled frame for transportation and also arrangements of switchboards in various gas-engine electric central stations. Two features are necessary in such a switchboard system—a two-storied board and electric control of the main oil switch. If the switch were mechanically controlled, the plan would be considerably more difficult to put into practice except for small currents. In most cases the lower story of the board contains the busbars and oil-switch circuit-breakers, each in its own cell. The panel of the board carries only the measuring instruments, the electric control mechanism of the main oil switch and the small operative transformers. All of the gear carries secondary, low-ampere, low-voltage current, and hence all of the panels can be arranged in a closed circuit which lacks merely a connection with a set of corresponding stub-end leads to become operative. The contacts are knife-blade spring keys,

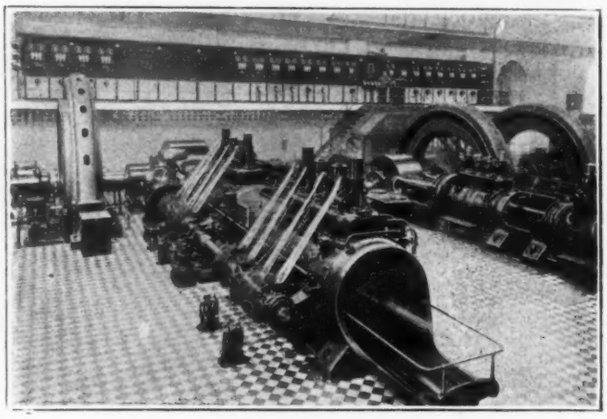


Fig. 2—Power House with Interchangeable Panel Switchboard at Mosel Hütten, Maizières.

requiring only that the panel be shoved in on its guide rails until the connections are completed. A lock, mechanically connected with the main oil-switch hand wheel, makes it impossible to connect or disconnect the panel unless the main switch is open and all current thus shut off from the panel.

Another typical form of removable switch panel is that used in the feeder panels for such boards as that of the Phoenix Hütten, of Ruhrort. In these the oil switch is attached to the panel frame and operated by the turn wheel as in Fig. 4. Only the busbars are mounted in the walled passage under the board and the main current is carried on the removable panel also. At the Phoenix works use is made of three-phase, 47-cycle current at 2100 volts. The feeder panel main contacts are high-tension, insulated snap-key plugs, which make contact automatically when the panel is pushed into place. By removing all the rheostatic control mechanism to a sort of desk at the front of the switchboard platform, with the resistor coil boxes below in the lower story, this same arrangement has been made adaptable to the engine panels, so that everything is interchangeable on this board except the special station instrument panels, such as handle the synchroscopes, frequency meters, power-factor meters, etc. The Phoenix board is also provided with emergency buses, an exceedingly desirable feature for test and special drive purposes in serving a large industrial plant. The adaptation of the emergency arrangement commonly employed in America to the removable panelboard involves simply the use of a double-throw switch in the basement for each panel with the two sets of buses at outer poles and the panel connection at the central poles. The above type of board is used in both of the Phoenix gas-

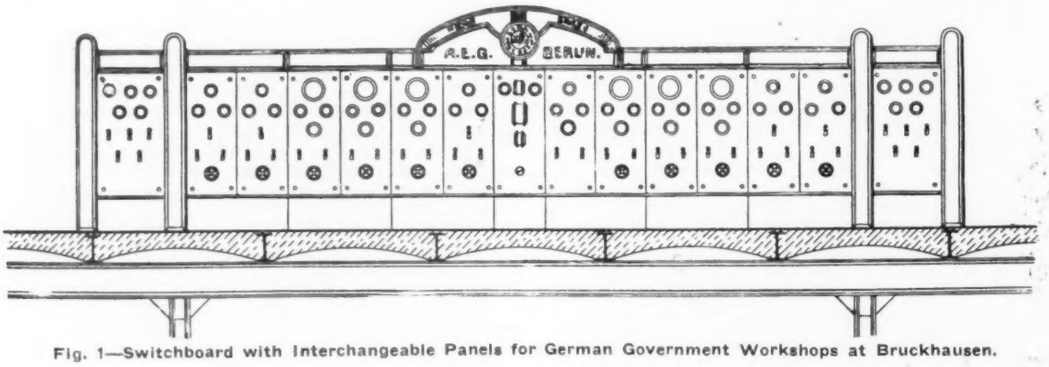


Fig. 1—Switchboard with Interchangeable Panels for German Government Workshops at Bruckhausen.

power houses, aggregating 12,000 hp in rating; in the Mozel Hütten at Maizières, of 5000 hp rating at 5600 volts; at the Luxemburg Hütten in Differdingen, and in the Donnersmark Hütten in Oberschlesien with 800-hp two-stroke-cycle gas engines. In general the panel carries, for engines, motor of from 500 hp to 2000 hp, and, in general, every generator in a large station where the main board is far distant from the engine itself, necessitates the use of some sort of an instrument column or starting panel adjacent to the machine. The objection to a panel is that it must be

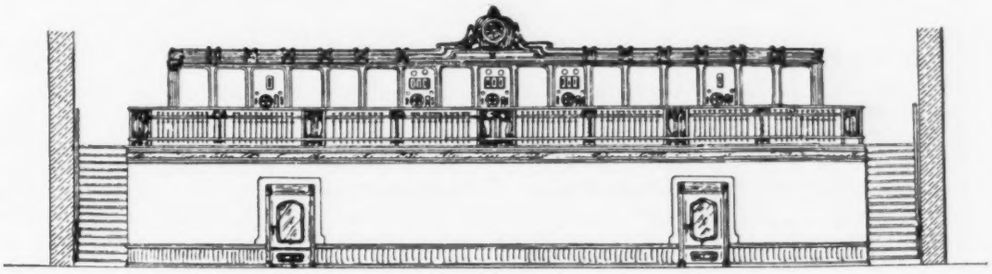


Fig. 3—Switchboard at Phoenix Hütten No. 2 Power House.

round-type direct-current field-circuit instruments, and edgewise-type alternating-current voltmeter, ammeter and indicating wattmeter mounted in a triple frame. The panel front, which is of sheet iron, is light, non-breakable and represents a marked improvement over the marble panel used in this country, even where every single instrument case is grounded as is also the shell of the switch apparatus.

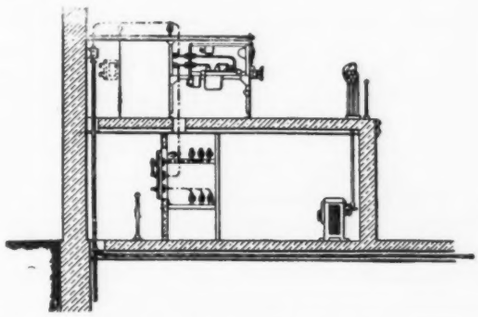


Fig. 4—Cross-Section of Switchboard No. 2 at Phoenix Hütten.

Because of the electric-controlled main switch the removable-panel system is especially adaptable to high-tension distribution installations. With the ordinary panel or distance-controlled mechanism, if the high-tension apparatus is disconnected from the buses by a switch, in many cases the cable remains under pressure, and usually it is necessary to use a further switch at the cable end, which complication is

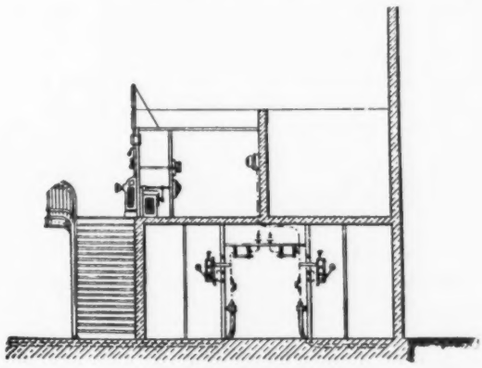


Fig. 5—Cross-Section Through Switchboard at Union Coal and Iron Industries, Dortmund.

rendered unnecessary by the removable panel system with the electrically controlled switch at the buses.

In connection with the switchboard control of large industrial energy-supply central stations, it may be well to mention here the extensive use that is being made abroad of the schaltsaule, or switch column. Almost every large

placed against either a wall or else a backing or case, and occupies valuable room on the engine floor. This objection is overcome by using instrument columns, several types of which are illustrated herewith. Use is made of a neat cast-iron column, surmounted by an iron box equipped with the control switches, which operate the main current switches under the column in the basement. Extending from this box there is room for five instruments in sub-

Fig. 6—Generator Switch Column.

Fig. 7—Switch Column for Large Motors.

stantial brackets, the voltmeter being usually at the top and the ammeters and wattmeters on the sides. The synchronizing lamps and the electric control switches are placed in the box. In addition hand-wheels may be mounted on the column, and the operating rheostats or bevel gearing connected to the oil switches in the basement below. When

only two or three engines compose the station equipment a single column, disposed conveniently to the three of them, is all the engine switchboard requires, the main board being used exclusively for the feeders. The great advantage of the switch column is that the operating engineer, in starting or handling an engine, has before him a record of just what he is doing electrically. The three-instrument type is almost a necessity for each individual engine unit in a large power station. With such an equipment the starting engineer can get up pressure, synchronize the generator and connect it to the main buses without looking at the main board, which indeed is so far away as to be of little or no use to him except for some such large station instrument as an illuminated synchroscope. The switch column is a great convenience in handling balky gas engines.

The second switch column illustrated is the preferred type for large motor control, to be operated in connection with a

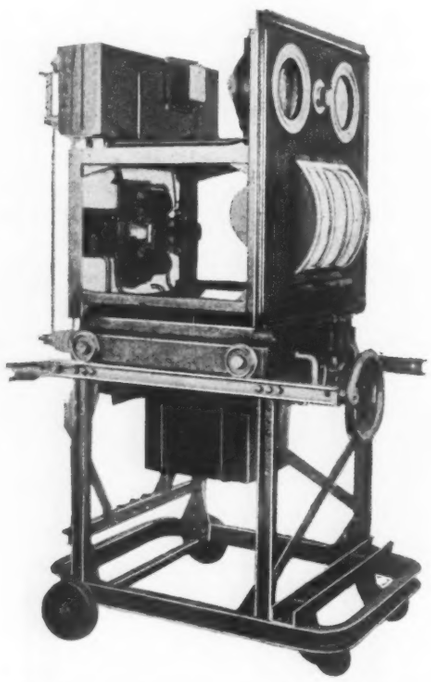


Fig. 8—Interchangeable Switchboard Panel on Emergency Truck.

suitable starting equipment. It is a plain wrought-pipe column supporting three instruments without any form of electric control switch. When stationed near a large motor it becomes the electrical eye for showing the attendant just what is going on, what emf is being produced and what current and power are being used. It is far handier about a factory than is any equivalent form of motor panel. Another type of switch column that may be mentioned is one for heavy-duty, large-current work. It is equipped with two edgewise instruments, mounted in a double frame at the top, and has two hand-wheels and a concentric hand-lever for mechanical operation of the switches, etc.

Though it has been mentioned in a former article,* this account should not be concluded without some mention of the universal use of the tachometer on all engines and turbines running in parallel in German power stations. A tachometer, mounted on a suitable column, is built with the engine and furnished as an integral part thereof. Its value is simply inestimable, in enabling the operatives to know what is the speed of the engine not only in total r.p.m. but in each part of every revolution. There is a considerable variation, both periodic and occasional, during every revolution of large gas-engines, running at from 94 to 106 r.p.m., even when equipped with flywheels which theoretically should maintain the speed uniform through all parts of every revolution. Such speed variation disappears with high-speed reciprocating engines, and with the turbines the variation is entirely occasional, being affected by wide fluctuations in the outside load. The gas engines have to adjust themselves not only to these variations, but to each other during all changes in load, which may be 3000 or 4000 kw within a few seconds. The tachometer gives instantaneous indications as to the operation of the gas engine in taking up these speed variations and how it is behaving in performing its share of the total work.

The switchboard acts not only as the business department of the power house, but also as its eyes and ears. It is highly necessary that these latter two functions be in good operative order all the time for all the factory, and hence every step that is being taken toward making the switchboard as simple, efficient and foolproof as is humanly possible should be of the greatest interest to all the electrical fraternity.

*Electrical World, Dec. 2, 1911.

THE SUPPLY OF ENERGY FOR TEN TOWNS FROM ONE STATION AT GREENVILLE, OHIO.

Experiences in Establishing a Large Distribution System in a Rural District—Form of Contract and Agreements with Local Distribution Companies.

By D. L. Gaskill.

Greenville, Ohio, is a city of about 7000 inhabitants, situated about 12 miles from the Indiana state line. The electricity supply is furnished by the Greenville Electric Light & Power Company, which was organized and began business in 1895, the owners being then engaged in professional and mercantile pursuits and knowing nothing whatever of the electrical business. Sixteen years of experience resulted in imparting much information to them with some losses and also many gains. The old station of the company contained reciprocating engines running condensing belted to a line shaft which, by means of clutch pulleys, drove the generators. Business so increased that in 1911 the company built a new generating room adjacent to this plant and installed therein two 500-kw horizontal Curtis turbines connected to Wheeler surface condensers. The steam generating conditions are good, there being plenty of river water for condensing. By means of a 2-ft. sewer installed 4 ft. below the bottom of the river and connected to a cement receiving well and intake the water is delivered within 10 ft. of the condensers by gravity and in such quantity as to afford ample water for four times the present equipment of the plant.

The cost of the new equipment was about $35,000, including the building, but this does not include the boilers, which are the same as were used in the old station. The improvement in operating efficiency of the equipment over the old is about 20 per cent, and as yet no troubles have developed in operation in nine months running.

This company supplies all the electricity used in its own city and in addition it supplies at its switchboard energy for the towns of Ansonia, Bradford and Gettysburg, Ohio. The first town is served by a single-phase, 8-mile, 6600-volt line, and the latter two towns by a 12-mile, 6600-volt line. The price received by the generating company for its energy is 3.5 cents per kw-hr. for the first 6000 kw-hr. used per month, all excess in the month being charged for at the rate of 2 cents per kw-hr.

In addition to delivering energy to these lines the company has under construction a 33,000-volt line, 35 miles in length, which will serve six other towns lying south of its home city and containing a total population of about 4000 people. The energy is transmitted from the generating station to a point just outside of the city of Greenville,

where the voltage is stepped up to the transmitting emf and at each town step-down transformers reduce the emf to 2300 volts, the energy being delivered at the corporation line of the towns served at that voltage. This line is of the single-phase construction, there being at present insufficient motor requirements to justify the construction of a three-phase equipment. The cost of the line, including transformers and all apparatus, has been approximately $800 per mile, the company doing its own construction, buying its own material and getting the benefit of lowest prices.

In each of the towns receiving energy, contracts are made for the service with companies formed locally for the purpose. The capitalization of these companies is set at the cost of the installation and the transmission lines and street-lighting equipment in the municipality served, which so far has been about $6 for each inhabitant. This cost includes the entire equipment, including fifty meters. Several advantages of contracting with local companies in the towns have been found by the generating company. In all small towns there is a sentiment existing against the larger town in the county, and where a generating station makes the street-lighting contract and collects all lighting bills, friction is caused between the inhabitants of the small town as against the central generating company, while if local capital is interested in the small town, street-lighting contracts are easily made and the enmity existing in the small town against the larger is avoided. In addition, the generating company, being located at some distance from the consumers in such towns, cannot be in as close touch with the situation as can a local company. Where possible, two or more towns are included under the same superintendent even though owned by different serving companies, and the generating company, having only its transmission line to maintain, is able at a minimum of expense to look after its service, while the local company, having only its local lines to look after and bills to collect, is enabled to give better service to the consumer.

The local companies in these towns do not enter into the field of wiring, but give the matter of selling supplies and wiring of houses into the hands of the superintendent, who buys the material and makes the profit on such work and devotes sufficient of his time to the local company to read the meters, collect the bills and make the necessary connections. In this way the local company avoids the high cost of superintendence, and the superintendent, being in business for himself, has an incentive to pushing the business of the local company, all of which inures to the benefit of the generating company, as the more installations are made the more energy will be consumed and the larger the income of the generating company.

In a town of 700 people, which started business in 1910, after fifteen months of operation, a net gain of $1,400 was shown after payment of all expenses and for the energy used. The capitalization was about $6,600, the company owning the line to the generating station. Starting with no business, this company had at the end of fifteen months seventy-two customers upon its books, in addition to the street lighting, which paid in excess of $1,500 per year.

In all of these towns a minimum charge of $1 per month is insisted upon and collected.

Where the energy is transmitted by the generating company to the corporation line of the municipality served, the generating company charges 4.5 cents per kw-hour at the corporation line. On strictly motor installations in such towns, a rebate of 1 cent per kw-hour is given on the total readings of the meter of such installations.

When necessary, the generating company takes stock in the local company but relies upon its contract with the local company for holding its business, which contract is in the following form:

"Contract between the Greenville Electric Light & Power Company and the ——— Lighting Company for furnishing electric energy for light, heat, power and other purposes at ———, Ohio.

"This contract, made this ———day of ———, 1912, between the Greenville Electric Light & Power Company, its successors and assigns, as party of the first part, and the ——— Lighting Company, its successors and assigns, as party of the second part, witnesseth:

"That party of the first part, now engaged in the operating of an electric light plant at Greenville, Ohio, agrees to furnish to party of the second part electric energy for light, heat, power and other purposes at the corporation line in the town of ———, Darke County, Ohio, upon the following conditions:

"First.—Said party of the second part shall purchase from party of the first part all electric energy used or sold by it, its lessees and assigns, during the full term of this contract.

"Second.—Said party of the first part shall construct and own the transmission lines for transmitting said energy from its station in Greenville, Ohio, to the corporation line in the town of ———, Darke County, Ohio, and shall keep said lines in good operative condition and maintain the same, furnishing all labor, material and repairs needed in the construction and the proper maintenance of said line. Said party of the first part shall also transform the emf at the corporation of ———, Darke County, Ohio, from the high voltage used in transmitting to 2300 volts or such other voltage as may be agreed upon by both parties to this contract.

"Third.—Said electric energy so furnished by said party of the first part to party of the second part is to be single-phase alternating current, 60 cycle and 2300 volts, unless another voltage is agreed upon between said parties. Said energy is to be furnished continuously throughout the twenty-four hours of each day excepting Sunday, at which time service may be discontinued during daylight at option of the party of the first part, and in case of accident or other unavoidable casualty, necessitating the shutting down of the machinery of party of the first part, or an interruption of the service on said transmission line by repairs or by unavoidable accident, this contract shall not be abrogated nor shall party of the first part be liable to party of the second part or to its patrons for loss of time caused by such shutting down or accident, and said party of the first part shall have a reasonable time in which to make the necessary repairs.

"Fourth.—Said party of the second part shall pay to party of the first part for such service and electric energy the sum of 4½ cents per kw-hour, the same to be measured after the voltage has been stepped down from the high voltage transmitted to 2300 volts or such other voltage as may be agreed upon between said parties. Such meter for such measurement is to be furnished by party of the first part and to be at all times accessible for reading to both parties to this contract, and party of the second part shall have the right, at its option, to install a check meter upon said measured line, which meter shall be so placed as to be read by both parties at their option. Payment for all energy furnished to party of the second part shall be made monthly on the fifteenth day of the month following the service.

"Fifth.—In case the progress of the electrical industry shall be such as to require improved service, then said party of the first part shall have the right to adopt such improved service in such manner as least to inconvenience said party of the second part. In case such change will create an added cost to party of the second part, then the consent of party of the second part shall be had to such change.

"Sixth.—This contract shall be for a period of ten years beginning on the ——— day of ———, 1912, and shall not be assignable by party of the second part without the written consent of party of the first part, and said party

of the second part shall not lease its lines to any one else for operation, unless such lease be approved by party of the first part. This contract may be extended for five years beyond the ten years contracted for at the option of party of the second part by giving notice to party of the first part within ninety days from the termination of this agreement.

"Seventh.—It is further understood and agreed that party of the first part shall not be liable for any accident or damage to any person or property that shall happen beyond the lines of party of the first part, and party of the second part shall not be liable for any accident or damage that may occur to persons or property along or on the lines of party of the first part.

"Eighth.—In the installation of motors on the lines of party of the second part it shall require such starting devices to be used as will prevent as far as possible any interference with the regulation of the voltage of both parties.

"Ninth.—It is further agreed between the parties to this contract that installations for the sale of energy for motor service shall be kept separate and distinct from lighting installations, and party of the first part shall have the right at any time to test and check up meters used by party of the second part in measuring energy for such motor installations, and party of the second part agrees that said meters shall be kept accurate and in good condition, and for the energy used in such motor installations party of the second part shall have a rebate of 1 cent per kw-hour from the 4.5-cent price. The manner in which such consumption of energy for such motor installations shall be kept account of shall be as follows: The total consumption of such motor installations in any month shall be settled for at the rate of 3.5 cents per kw-hour, the total amount of such energy consumption by motor to be deducted from the total reading of the meter that registers all energy used by party of the second part, and the remainder to be governed by the price herein stipulated of 4.5 cents per kw-hour.

"In witness whereof the parties have hereunto set their hands this ——— day of ———, 1912."

As will be noted from the above contract, the small towns get the benefit of city service the equivalent of which it would be impossible to have by operating generating stations of their own.

The experience of three years with a line serving Bradford and Gettysburg, Ohio, has demonstrated the necessity of building a line so as to be absolutely clear from interference with trees. It has also demonstrated the necessity of having the highest class of transformers so that the transformer losses will be as low as possible.

While it should be desirable for a generating company to have the local companies build a transmission line to their switchboard, yet it was found by this company that such construction limited the future business of the generating company, as the owners of the transmission line often did not care to extend to other towns further on, and in that way the generating company was blocked from extending its lines into what would be profitable territory. By owning the transmission line and adding 1 cent per kw-hour to cover the losses in transmission, the generating company has avoided this difficulty.

No farmers as yet are obtaining energy from the high-tension lines. The Greenville company is serving some farmers on 2300-volt lines leading from 2.5 to 3.5 miles from the station to large public buildings, namely, the County Infirmary and Children's Home. About a dozen farmers are using the service and it is found that their bills average about $1.50 per month. It is found that the farmer is not slow to take up electrical appliances, and in every installation the farmer uses at least one flatiron in addition to his lamps.

The centralization of the generation of electricity in large plants and transmission of the same to serve smaller communities is sure to become universal in this country, as the service which can be supplied by a generating plant in a small town is so inadequate and so far behind the times that the public will not be content with it. An experience of three and a half years has demonstrated that where care and attention are bestowed upon the line transmitting the energy the service is practically continuous without interruption.

OIL ENGINES FOR CENTRAL-STATION PRIME MOVERS.

An interesting summary of the types, properties and special qualifications of the various oil engines now available in the American market was presented by Mr. Earle D. Jackson, consulting engineer, St. Paul, Minn., in a paper on the subject of "Oil and Other Internal-Combustion Engines" read before the Minnesota Electrical Association at Minneapolis, March 20.

Oil engines in general are divided into two classes, said Mr. Jackson, the instantaneous-explosive type and that in which pure air is first highly compressed and the liquid fuel in atomized form injected during about 10 per cent of the combustion stroke, the fuel being vaporized and burned, without explosion, owing to the heat of compression. In the first class of engines compression cannot be carried beyond 60 lb. or 70 lb. per square inch owing to the danger of pre-ignition, unless water is injected. Hence the term "low-pressure engine" is given to this class. In the second class, however, since only pure air is compressed, compression is carried up to 500 lb. or 800 lb. per square inch, equivalent to 1000 deg. Fahr. Low-pressure engines are, of course, less expensive in construction and less economical of fuel than the high-pressure engines. Descriptions of types of the two general classes follow:

The Fairbanks-Morse oil engine, which is of the low-pressure type, is made for central-station servive in 50-hp, 80-hp, 100-hp, 150-hp and 200-hp sizes. It runs on gasoline, naphtha, benzine and the kerosene oils down to a 39 deg. Baumé distillate, the fuel spray being heated and vaporized by the exhaust gases. The mixture is ignited by electric spark, pre-ignition being prevented by injection of water. The fuel consumption per bhp-hr. on 39 deg. distillate (a low-grade kerosene, costing 4½ cents per gal., delivered, in the Minnesota territory) is 0.13 gal. or 0.90 lb., a fuel cost of 0.585 cent. The 200-hp engine weighs 200 lb. per hp and costs approximately $40 per hp, f.o.b. factory at Beloit, Wis.

The Covington oil engine, built by the Covington Machine Company, Covington, Ky., is of the low-pressure type and is made in 50-hp single units and 100-hp twin units. It may be run on distillates down to 24 deg. Baumé or 0.913 specific gravity. Explosion is produced by heat from the vaporizer cap and that added by the compression stroke. The vaporizer retains the products of combustion, protecting the cylinder walls and piston rings from carbon deposits. The maximum pressure in the cylinder rises to 180 lb. per square inch. A high-speed governor varies the fuel-pump stroke by altering its fulcrum. On solar oil, a by-product distillate of about 32 deg. Baumé, sold by the Gulf Refining Company, for which this engine is probably best adapted, consumptions as low as 0.73 lb. or 1.10 gal. per hp-hr. have been obtained at rated load. This oil contains 18,600 heat units per lb. and in tank cars at Minneapolis costs about 4 cents per gallon, making the fuel cost per bhp-hr. 0.40 cent, with a thermal efficiency of 18.8 per cent. The guarantees of the company, however, call for 1 lb. of oil per bhp-hr. The weight of the 100-hp Covington engine is approximately 260 lb. per hp, and it costs $49 per hp, f.o.b. Covington, Ky.

The Mietz & Weiss oil engine, made in sizes from 2 hp to 400 hp, is a low-pressure engine, although the maximum

cylinder pressures, due to heat of combustion, rise to 300 lb. per square inch. It is offered to run on alcohol, crude oil and its distillates, but from an operating standpoint apparently the best results are obtained with the so-called "solar oil." On the forward stroke air is compressed, a port, opened by the piston, allowing it to pass, with the steam generated in the water jacket, to the combustion space. At the same time, the exhaust port, opened by the piston, discharges the products of the previous combustion. Fuel is injected by a small pump and mixed in the cylinder with air and steam, on completion of the compression stroke, the mixture of air, oil vapor and steam being automatically exploded because of compression. On solar oil, the consumption at full load is 0.75 lb., a cost of 0.4 cent per bhp-hr. On oil of 34 deg. Baumé factory tests have shown a consumption of 0.64 lb. per bhp-hr., corresponding to a thermal efficiency of over 21 per cent. The 100-hp engine weighs 230 lb. per hp and costs $55 per hp, f.o.b. New York.

The Hornsby-Akroyd engine, another low-pressure machine, is made by the De La Vergne Machine Company, New York, in sizes from 10 hp, single-cylinder, up to 100 hp, two-cylinder. Claims are made that it will run on kerosene or any of the crude oils, but most excellent results are obtained by using distillates, 24 deg. Baumé or lighter, containing 18,000 heat units or more per pound and a flash point between 100 deg. and 250 deg. The heat of the vaporizer cap ignites the mixture. Maximum cylinder pressures approximate 190 lb. per square inch at the moment of explosion. The fuel consumption approximates 0.75 lb. per bhp-hr., using 24 deg. distillate, although the guarantees call for 1 lb. The 100-hp engine costs $44 per hp, f.o.b. factory.

The American Diesel engine, as built by the Busch-Sulzer Brothers Diesel Engine Company, St. Louis, is designed to operate on either crude oil or its distillates, preferably the cheaper grades. During the compression stroke pure air in the cylinder is compressed to 500 lb. per square inch, the temperature resulting, 1000 deg. Fahr., being sufficient to ignite any form of crude or refined oil. A charge of oil and compressed air at 750 lb. to 1000 lb. pressure is then blown into the red-hot air in the cylinder, this injection continuing for about 10 per cent of the expansion stroke. The hot gases then expand until when the piston has traveled 90 per cent of its stroke the exhaust valve opens. The last stroke of the cycle is the usual scavenging stroke. The temperature of the exhaust is normally about 700 deg. Fahr. The manufacturer guarantees that consumption shall not exceed 8 gal. per 100 bhp-hr. at loads between 50 per cent and full rating. With crude oil at $0.0325 per gal. delivered in the Minnesota territory, the cost of fuel would be something over $0.0025 per bhp-hr. The oil, however, must be not heavier than 19 deg. Baumé, must be free from acid and foreign matter and contain not more than 0.33 per cent of sulphur or water. The weight varies from 300 lb. to 450 lb. per hp, depending on the size of the engine. The 170-hp engine, running at 200 r.p.m., weighs 380 lb. per hp and costs $70 per hp f.o.b. factory. Under working conditions at or near full load, the American Diesel engine should develop 1 bhp-hr. on 0.5 lb. of oil, corresponding to a thermal efficiency of about 30 per cent.

The Atlas crude oil engine, built by the Atlas Engine Company, Indianapolis, Ind., in sizes of 300, 450, 600 and 900 bhp, is similar in principle to the Diesel type.

The De La Vergne Type F. H. engine is a combination of the Diesel principle with the hot vaporizer-cap arrangement of the Hornsby-Akroyd engine. The air in the cylinder is compressed to 300 lb. instead of 500 lb. as in the Diesel engine. As the resultant temperature will not ignite the oil, the latter is sprayed by air at 600 lb. pressure across the combustion chamber into the hot bulb heated by previous ignitions. An explosion takes place, causing a pressure rise to about 500 lb. in the cylinder, followed by combustion at constant pressure. In starting the engine the vaporizer is heated by a kerosene-oil blast lamp, requiring about fifteen minutes. Owing to the method of ignition above described, the manufacturers claim that the requirements of their engine are less severe than the Diesel type and apparently do not wish to have their engine classed with the high-pressure engines. By a starting lever which relieves compression the De La Vergne engine starts on about 150 lb. air pressure. The weights of the De La Vergne engine average over 400 lb. per hp, and its cost is approximately $70 per hp, f.o.b. factory.

The fuel guarantees are very low, 0.60 lb. per bhp-hr., at full load, with oils not heavier than 18 deg. Baumé. Consumptions as low as 0.374 lb. of oil per hp-hr. have been obtained in test. The manufacturer claims that this is the only oil engine on the market which will run satisfactorily on oils as heavy as 16 deg. Baumé.

Comparisons drawn between the low-pressure and high-pressure oil engines show that the fuel consumption of the low-pressure engine is from 50 to 100 per cent greater than that of the high-pressure engine at full rated load, and at light loads this difference becomes still greater. The low-pressure engines have limitations as to the gravity of the oil suitable, ranging from 39 deg. Baumé for the Fairbanks-Morse type of engine to 24 deg. Baumé as an average for the other types of low-pressure engines. In other words, the low-pressure engines are practically limited to the distillates, while the high-pressure engines may be operated on the crude oils within the limitations that have been given. The weight per hp of the low-pressure engines averages 30 per cent less than for the high-pressure engines, the cost averaging also about 30 per cent less. The speeds of the low-pressure engines are higher than the speeds of the high-pressure engines. The low-pressure engines require more cooling water per bhp-hr. than do the high-pressure engines.

In comparing steam, producer-gas and oil engines builders sometimes abuse the term "thermal efficiency," which is simply the ratio of output to input in terms of heat units. Thus it is stated that steam plants have a thermal efficiency of 6 to 20 per cent, producer-gas plants an efficiency of 15 to 23 per cent, while oil engines have a thermal efficiency of 30 to 33 per cent for the high-pressure type. However, the cost of fuel per heat unit, say for coal or lignite in the steam or producer-gas plant, may be widely different from the costs per heat unit of oil for the oil engine, so that such comparisons stated only on a basis of thermal efficiency, with fuels of totally different character, availability and cost, are misleading for practical considerations.

In comparing liquid fuels, statements as to relative thermal efficiencies obtained with the different fuels are also likely to give false impressions. Thus, when gasoline is used for a liquid fuel in an internal-combustion engine, the thermal efficiency may run as high as 22 per cent, as shown by government tests, while the same engine using alcohol will show a thermal efficiency of 34 per cent. However, gasoline at a thermal efficiency of 22 per cent, costing 12 cents per gal., is a vastly better proposition than alcohol with a thermal efficiency of 34 per cent and costing 44 cents per gal.

Thermal efficiencies are therefore of value only when the comparisons are made on the same fuel or when the thermal efficiencies are multiplied by the cost factor of the fuel.

The cost of a complete high-pressure oil-engine plant of 500-hp rating will average about 25 per cent greater than a simple Corliss or high-speed compound steam plant, running condensing, with hand-fired, water-tube boilers. The first costs of a low-pressure oil plant will, as a rule, average less than for the steam plant above described.

The high-compression oil engine, with its high fuel economy and high first cost, is necessarily a "high-load-factor" machine; that is, it must be operated at a high load-factor to obtain better economic results than its less costly

and less economical competitors, because its fixed charges, interest, depreciation, insurance and taxes are relatively much higher than its fuel costs. The high-pressure oil engine can therefore show its best results when used for industrial purposes such as operating factories, mills, etc., or wherever there is a high load-factor. As a reserve for water-power and as a peak-load unit it frequently cannot show the economic results of the low-pressure oil engine. The low-pressure engine more nearly approaches steam operation in its economic characteristics, with its lower first cost and lower fuel economy.

The proper choice of oil engines should therefore be based on considerations of first cost of the plant, fuel consumption, price, source and stability of supply of the oil fuel, load-factor and percentage of load at which the engine will chiefly run.

THE INSTALLATION OF ELECTRIC APPARATUS.

By Everard Brown.

The installation of electric apparatus should be so governed that, so far as possible, the danger of fire resulting from its use will be minimized and at the same time the greatest degree of safety for employees provided. In addition to this it should be made with a view to reducing to the lowest degree all troubles and repairs which are usually attended by shut-downs and expense. Strict supervision should be observed in this respect, no matter whether the installation is made by the company or by the contractor. While it is true that the state and local laws governing each class of work must be complied with in every respect, nevertheless there are many little so-called "kinks" that may be introduced that will be of benefit to both owner and operator.

It should be self-evident that workmanship and material cannot be too good. The cost of a good installation is very little, if any, higher than that of a poor one, and the reduction in operating costs will amply justify it. Furthermore, the attendants will take more pride in a neat, substantial and workmanlike installation and will give it more attention and better care than they will a poor one. All joints and splices in wires or cables should, without the use of solder, be equal in mechanical strength and electric conductivity to the conductor in which such joints occur. They should also be well soldered and should have an insulation not less than that on the conductor itself. Good practice also demands that no wires or conductors carrying electric current be permitted to come in contact with inflammable material other than their own insulation. When burying wires under ground there is danger of their becoming broken because of the settling of the ground or from heavy weights passing over them. To eliminate this danger the buried wires should be slack enough to allow for any settling that may occur.

When conduit is used in a power station it is advisable to consider it as a mechanical and fire protection only, not as an insulation, and only circuits carrying the same kind of current at the same differences of potential should be run in one conduit. Junction and service boxes, fittings, etc., of metal or other non-combustible material are advocated. This also applies to boxes for the protection of switches, fuses or other live parts. Suitable means for locking the switches open should be provided for the protection of men working on the apparatus controlled, and in all cases single-throw knife switches should be installed so that the force of gravity will tend to open rather than close them. Double-throw switches may be mounted horizontally or vertically as preferred. To further the safety of the men when working on the circuit or apparatus it is advisable to have disconnecting switches intended to be used only when power is not being transmitted. They should be of strong and rigid construction and allow closing on live circuits with a quick motion and a good conduit. They can be safely operated by a hook with a dry wooden handle of safe length, which should always be easily accessible. The use of open fuses is always a source of danger, and the plug or cartridge type, as conditions demand, is preferable.

Lightning arresters of approved design are a necessary part of all electric installation, and in putting them in good ground connections are most important and no attempt should be made at economizing in this respect. They are usually located in easily accessible places at a sufficient distance from wires and other inflammable material to prevent danger from fire. If this is not practicable, however, they may be protected by suitable non-combustible barriers. A thorough inspection of them at least once a month and also immediately after any electrical storm should be made imperative.

Another important consideration in connection with electric power plants is that of properly grounding all steel buildings, poles or towers, metallic conduits, etc., and failure to observe this point may result in fire, accident or even loss of life. Usually two grounding places are provided for steel buildings of ordinary size, but for larger buildings the number of grounds should be in proportion. There are several ways in which suitable grounds may be made, such as putting a large copper plate, surrounded by from 12 in. to 18 in. of crushed coke, in ground that is permanently damp, or putting in a steel plate, casting or bunch of copper strap similarly embedded. A good connection of the wires to the embedded mass should be made; otherwise the purpose of the installation is, to a large extent, lost.

A WATER-POWER ICE PLANT NEAR JOPLIN, MO.

In combination with its Grand Falls water-power plant, situated 4 miles southwest of Joplin, Mo., the Empire District Electric Company operates a 25-ton raw-water ice factory whose output is shipped by rail into Joplin and there wholesaled to a dealer. This unusual location for an ice plant is explained by the history of the Grand Falls site. First developed as a water-power, a steam auxiliary was later found necessary and added, and then an ice plant was logically combined with the steam-engine operation. Following the construction of the modern steam stations of the Empire system, the Grand Falls steam machinery was

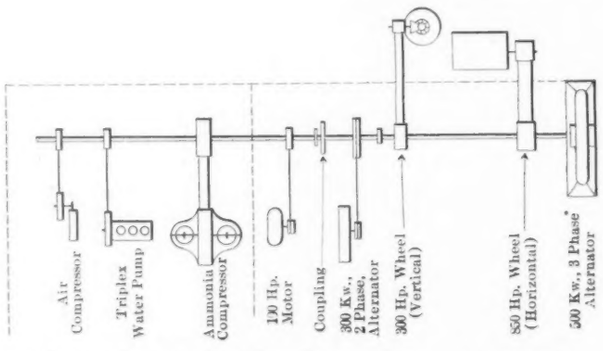


Fig. 1—Plan of Grand Falls Water-Power and Ice Plant.

dismantled, leaving the water-power and ice-making equipment now in service.

Fig. 1 shows the arrangement of the water-power and ice-making departments, operating from separate shafts, which are so aligned and speeded that they can be coupled if desired. The main 6-in. water-power shaft is rope-driven by one 850-hp Leffel turbine and one 300-hp Trump turbine, and drives in turn a direct-connected Westinghouse 500-kw, 6600-volt, 25-cycle, three-phase alternator and a reserve

300-kw, two-phase Stanley inductor alternator. The 5-in. ice-plant shaft is belt-driven by a 125-hp Westinghouse 2200-volt, 25-cycle, three-phase motor. From it are operated a York twin-vertical ammonia compressor producing 50 tons of refrigeration per day; a 5-in. by 8-in. Dean triplex water pump running at 50 r.p.m., which provides all

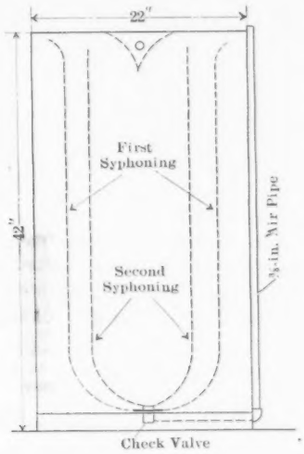


Fig. 2—Section Through Can, Showing Successive Cores During Freezing.

the plant circulating and ice-making supply, and a 12-in. by 14-in. simple air compressor delivering air at 80 lb. pressure. The shaft coupling between the water-power and ice-making sections makes it possible to drive the ice plant directly from the waterwheels in case of any accident to the electrical machinery. Although several of the smaller auxiliaries are motor-driven, the operation of the ammonia, water and air pumps directly from the waterwheels would enable a freeze already started to be completed, in spite of electrical interruption. In times of drought, when the water supply is not sufficient to drive the ice plant, the latter can be operated back over the 33,000-volt system from other interconnected steam plants. The freezing tank and ice-storage rooms are contained in a separate building adjoining the machinery building.

Raw water taken from the headrace is used for ice making. The triplex circulating pump mentioned delivers the supply to one of two 8000-gal. settling tanks when alum solution is added to precipitate turbidity. A bucketful, or 2 gal., of the solution usually suffices for a tankful of water, and this clears itself ready for use in six hours. The two tanks are required to furnish the 15,000 gal. used daily, and each container is thoroughly flushed after emptying. From the settling basins the treated water passes through 5 ft. of sand filter, followed by a paper filter, before being delivered to the can room.

The freezing tank contains 361 300-lb. cans, each fitted with a 3/8-in. air pipe (Fig. 2) opening into the bottom of the can through a check valve. The compressor pressure of 80 lb. is throttled down to about 4 lb. per square inch at the cans, only sufficient pressure being required to deliver the air against the hydrostatic head of the water. In case of failure of the air supply the can check valves close to prevent siphoning of the water out of the cans. Before delivery to the cans the air is pre-cooled to about 10 deg. Fahr., drying it and avoiding clogging of the air pipes which would be caused by freezing of moisture.

Freezing is carried out on a forty-eight-hour cycle, each can being siphoned twice before being finally frozen solid. The cans measure 42 in. by 22 in. by 11½ in., and during the first twenty-four hours a shell of ice 4 in. thick is built up inside, as shown in Fig. 2. The water from the center, containing the impurities that have separated out from the ice, is then siphoned off and replaced by fresh water. Six to eight hours later another 3 in. of ice has been added inside the first shell, and the center core, 1 in. to 2 in. thick and of the dimensions illustrated, is again siphoned out and replaced with a clean supply. This core then freezes solid, the impurities collecting in a little granulated snow cone, 2 in. by 4 in. in base area and 5 in. deep, at the top of the cake. Ice of remarkable purity and clearness is obtained in this way. Newspaper small print, for example, is read easily through the 11-in. thickness of the cakes.

A 2-hp motor drives the freezing tank agitating impellers, as well as the pump which circulates salt brine from the tank through the coils for cooling the loading room. A separate expansion tank and a 5-hp brine pump are provided for the calcium-chloride brine which refrigerates the four ice-storage rooms. These measure roughly 40 ft. by 45 ft. each, and, piled full of 300-lb. cakes while preserving a 1-ft. air passage at the walls, the four rooms will hold 3000 tons. Ice is manufactured at the Grand Falls plant nine months in the year, the surplus being stored in the refrigerated rooms and shipped as needed during the warm season. Under normal working conditions 26 tons to 27 tons of ice is produced per day, and the product finds a ready sale in competition with the distilled-water ice made by three steam-driven ice plants in Joplin.

SIMPLE METHODS FOR INCREASING EFFICIENCY IN SMALL POWER PLANTS.

By L. B. Webster.

The cost of operation of any power plant depends more upon the watchfulness of the men in charge than on anything else. No matter how much attention has been given to the design of a power plant, the main factor in determining how economically it can produce the power required depends on how closely its engineers study operating conditions and on how much thought they give toward improving them. Proportioning the load among several units so that each unit will carry its most economical load will, of course, mean maximum economy for the plant as a whole. In order to do this, the load on every unit must be carefully kept track of by means of log sheets and load curves, so that a unit can be put in operation or shut down immediately whenever the fluctuations in the load warrant it. Any device which will enable the load to be carried

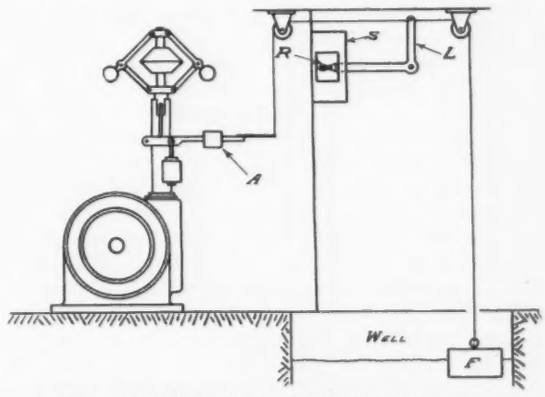


Fig. 1—Automatic Control of Engine Governor.

without unduly burdening the machines in operation and also render unnecessary the starting up of an additional unit to carry peaks in the load will be a great help toward increasing the efficiency of the plant.

A good illustration of this was observed in the improvement in plant operation in a sewage-pumping plant in a city of 50,000. A simple arrangement for making the engine governor more sensitive to variations in the load not only made it possible for the smaller of two pumps to

handle the ordinary flow of sewage throughout the day, where formerly the larger pump was in service in its stead for a few hours, but also greatly reduced the amount of attendance required in the engine-room.

At the plant in question the sewage of the city flowed by gravity into a well located at the plant. The quantity flowing into the well fluctuated greatly during short intervals. From the well the sewage was pumped against an average

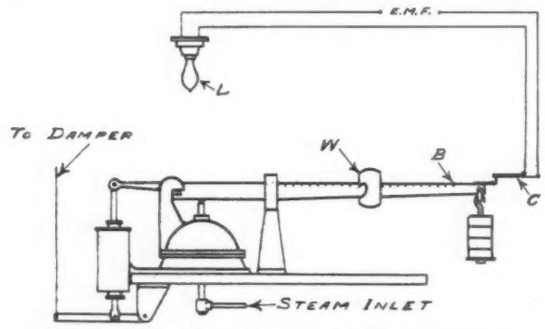


Fig. 2—Lamp-Signal Control of Boiler Pressure.

head of about 35 ft. by means of centrifugal pumps connected by belts and friction clutches to a line shaft, which was in turn belt-driven by a single-cylinder Corliss engine. The engineer had to be constantly watching the water level in the well. If the inflow of sewage increased suddenly, a larger pump had to be put into service; if the rate of inflow decreased, the engine had to be slowed down to prevent the pump from losing its vacuum by pumping the well down below the level of the mouth of the intake pipe.

Fig. 1 shows the method used to reduce the fluctuations in the load on the plant by making the pumping apparatus more sensitive to changes in the quantity of water to be pumped. The weight-arm *A* on the engine governor was conected to a float *F* on the surface of the water in the well. By reason of the quick action of the governor, a slight rise in the water level would cause the pump to speed up immediately and pump out the increasing inflow of water before it had time to accumulate. In a conspicuous place in the engine-room a lever *L* was placed, one end of which was fastened to the cord connecting the float to the governor weight-arm, and to the other was fixed a red light *R*. A screen *S*, with a hole in its center, was placed in front of the red light. As long as the engineer could see the red light he would know that the water in the well was maintained at the proper level.

The improved regulation afforded by this connection between the engine governor and the sewage well made a saving in coal and also a considerable saving in labor, as the engineer, whose time was formerly devoted entirely to watching the pumping operations, was now able to do repair work in the engine-room.

Another example of how a power plant's efficiency was increased by the attention of those in charge to a detail of operation is in a central station supplying energy for lighting and motor service to a city of 40,000. The station load is usually carried by one or two large units, which are supplied with steam at 150 lb. pressure during the hours of maximum load. A little experimenting showed the management that a good gain in economy, both at the engines and at the boilers, would result from carrying a reduced steam pressure during the periods when the station load was light.

To keep the steam pressure regular and yet allow it to be varied through a considerable range at the desire of the engineer, a lamp was posted in a conspicuous place in the boiler-room and connected through a pair of contact points on the end of the weight beam of a damper regulator of the usual type, which was located in the engine-room. Fig. 2 shows the lamp *L* in the boiler-room and the weight beam *B* of the damper regulator, on the end of which the electric circuit to the lamp is completed through the contacts *C*. When the steam pressure is too high the end of the beam will rise and press the contacts together, thereby causing the lamp in the boiler-room to burn steadily. When the steam pressure is too low the beam falls and the lamp goes out. When the steam pressure is steady the beam will just balance, and its vibrations will "make and break" the contacts *C*, which will cause the lamp in the boiler-room to flash intermittently.

When the engineer on duty wishes to change the steam pressure of the plant he shifts the weight *W* along the beam *B* to a point corresponding to the new pressure desired. The lamp in the boiler-room will then either go out or burn continuously. In the former case the firemen know that the pressure the boilers are carrying is too low, and will force the fire, and in the latter case they know this pressure is too high and will not fire quite so hard. As soon as the lamp again flashes intermittently they know that they have produced the exact steam pressure desired by the engineer.

OPERATION OF DIESEL OIL ENGINES.

Reports from a number of users of Diesel-engine sets, made in reply to fifty letters of inquiry sent out by a prospective purchaser, were summarized by Mr. Earle D. Jackson, of St. Paul, before the convention of the Minnesota Electrical Association held at Minneapolis March 20.

One operator of a 170-hp engine in an industrial plant in the Minnesota territory reported that oil cost him 3.75 cents per gallon delivered. Operating at full load for ten hours daily, his daily costs of oil and lubricants are: Fuel oil, $3.75; lubricants, $1; kerosene for starting, $0.25; total, $5. He estimates that he is saving $5 per day in fuel costs over his former steam plant. Operating troubles are: difficulty at times in starting the engine, in some cases resulting in complete loss of air pressure, which it requires two and one-half hours to regain; oil-pump troubles, congealing of oil in pipe line in cold weather, numerous minor shut-downs, and one shut-down of two days due to a burned-out babbitt. The owner seemed satisfied with his engine, but would not advise its use in an electric-lighting plant where continuous operation was desired unless there were other sources of power on which to fall back in case a shut-down was necessitated by any of the causes mentioned.

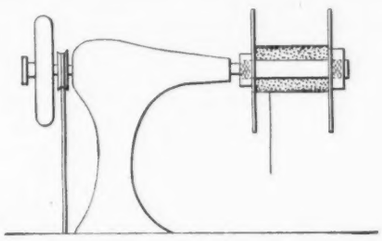
Another user of an oil engine, operating an electric lighting plant in Kansas where oil costs 2 cents per gallon, states that it is the best prime mover he has seen in his seventeen years of experience. A user in the Minnesota district declared that he was in general satisfied with his engine, but advised against its use as the only source of electric power for a central station. He reported that oil, 28 deg. to 30 deg. Baumé, costs him 3.6 cents per gallon, delivered, and that in order to operate his engine 6.5 gal. per 100 bhp-hours is required.

In general, the reports seem to indicate that the most serious troubles and the principal sources of expense in connection with the operation of the engines (most of which had been used from one to three years) were due to cracked cylinder heads, broken connecting rods and crank shafts, to reboring of cylinders, to carbon deposits and valve grinding, and to replacement of piston rings and fuel injection accessories, valves, needles, atomizers, etc. Cost of repairs per engine per year varied from a nominal sum up to one instance of $700, the latter high figure being mainly due to cracked cylinder heads. The average cost of repairs and renewals was between $200 and $300 per engine per year, or from 2 to 3 per cent of the cost of the engines.

Letters on Practical Subjects

COIL WINDER MADE FROM SEWING MACHINE.

The accompanying sketch shows how a sewing machine was modified and adapted to serve as the mounting for a coil-winding machine. With its aid, arc-lamp coils for which a fancy price was formerly paid to cover manufac-



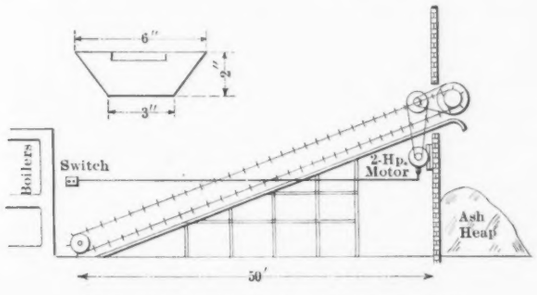
Coil Winder for Arc Lamps Made from Sewing Machine.

turing cost, shipping, etc., can now be wound up at the mere cost of the wire, since the station operator has a good deal of spare time which he can devote to advantage to this work. A ¼-in. nipple forms the spindle of the coil spool, the sides of which are held in place by the tapered nuts adapted from fixture fittings. The outer disk piece is removable, so that the finished coil can be slipped off the reel, or the spool itself can be taken off and replaced by any one of a series of various sizes for winding different coils. The sewing machine was purchased at practically junk value from a second-hand store and had its needle mechanism and frame cut off with a hack-saw.

Toledo, Ohio. GEORGE POLLOCK.

DRAG-CHAIN ELEVATOR FOR REMOVING ASHES.

Wheeling ashes by hand from the pits to the pile outside the building was the method formerly used at one of our small power plants, where the ashes are collected and hauled away by farmers. The drag-chain incline shown in the sketch has now replaced this transfer by hand, a 2-hp motor performing the work that formerly took the fireman away from his furnaces. An inclined V-shaped trough was built from the floor near the boilers to the window, 50 ft. distant and nearly 20 ft. higher. Over this inclined trough is dragged the sprocket chain shown, which at 1-ft. intervals is provided with the trapezoidal blades reproduced in detail herewith. Ashes shoveled into the trough at the bottom are carried at a velocity of 4 miles to 6 miles an hour up along the trough and dumped through the window onto the storage pile beneath. The sketch shows the method of



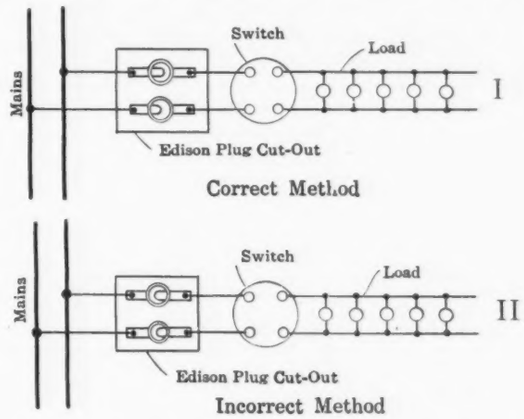
Drag-Chain Elevator for Removing Ashes.

driving the drag-chain sprocket-wheel through the belt and bicycle chain from the wall-mounted motor. The latter is controlled from the front of the boilers, so that it can be started without difficulty each time that there are ashes to be discharged.

New York, N. Y. CLEMENT JONES.

RIGHT AND WRONG METHODS OF CONNECTING PLUG CUT-OUTS.

In connecting Edison plug cut-outs they should always be so arranged that the screw shells, which extend beyond the porcelain, will not be alive normally. The accompanying illustrations show the right and wrong methods respectively. If connected incorrectly, there is constant danger of short-circuit or shock when men are working about the cut-outs with bare wire ends or tools. Some types of



Correct and Incorrect Methods of Connecting Edison Plug Cut-Outs.

plug cut-outs are so constructed that the porcelain is higher than the screw shell, which is thereby protected. Such cut-outs would be properly connected as shown in either I or II, and they should be selected where possible.

New York. H. M. SANDERS.

WETTING COAL FOR BOILERS.

It is common practice for the fireman in the boiler room, especially where the boilers are hand-fired, to wet the coal by means of a hose. This is particularly true where slack is used for fuel. Upon inquiry as to the reason for adding water to the fuel the reply is, usually, that it reduces the dust and dirt attendant upon the shoveling of slack and also that it makes a "hotter fire." The first of these statements is, no doubt, very true, but whether water adds anything to the quality of combustion or not is a question that is more difficult to determine. Even where mechanical stokers are in use and where the question of coal dust is of secondary importance, not uncommonly water is sprayed upon the coal either at or before it reaches the hopper.

Opinion as to the efficacy of this practice in order to increase the efficiency of the boilers seems to be pretty evenly divided, although the writer knows of no tests that have been made upon which any decided opinion can be based. In fact, practical tests that have come to our knowledge so far are not very convincing that water will add anything to the heating value of the coal. On the other hand, any moisture at all in the coal is usually considered detrimental, as it must be evaporated and brought up to the temperature of the other gases; all of which consumes a certain amount of heat that would otherwise be absorbed by the boiler. This view has been taken by several of the authorities on combustion, although in some instances their statements are so qualified as to limit the opinion to the heating value only of the coal.

There is, however, a decided advantage in the use of a certain amount of water, especially where chain-grate stokers are employed, because wet coal is more cohesive than dry coal, and hence a less amount will sift through the grates. Therefore less combustible material will be lost in the ash. It is also possible to carry a thicker fire and run the stokers faster where such would be advantageous, and thus, perhaps, to increase the permissible out-

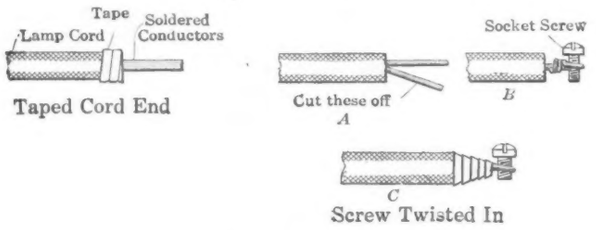
put of the boilers. Moreover, the use of water would tend to prevent the formation of holes through the fire. Whether or not these advantages will, in the aggregate, offset the amount of heat consumed in evaporating the water and heating the vapors is a problem that will probably have to be solved for each individual installation. If they do not, then there is no advantage in the use of water.

There is also another feature that must not be lost sight of in the careful consideration of the subject, namely, the action of the wet coal on the metal with which it comes in contact. In the first place, if water is to be used at all with any degree of efficiency, it should thoroughly permeate the coal before it enters the stoker hopper, as any unevenness in wetting will in all likelihood cause a variation in the rate of combustion. This means that the spraying should be done while the coal is in the overhead bins, the result of which will be a more rapid deterioration of the bins, chutes, etc., than would occur with dry coal. In some plants the bins have been lined with a thin layer of fine concrete or cement which has increased their life considerably, although this construction may not have been adopted because of the action resulting from wetting the coal.

Pittsburgh, Pa. EVERARD BROWN.

CONNECTING CORDS IN SOCKETS.

In fastening cords in sockets some precaution should be taken to prevent stray strands of wire from coming in contact with metal and thereby causing short-circuits or grounds. This can be accomplished by dipping the bared conductor of the cord in molten solder before it is made up under the binding screw. Strips of tape about ¼ in. wide, torn from wider pieces, are sometimes wound about the braid at the end of bared cord, to prevent the braid from



Fastening Cords in Sockets.

unraveling. A fairly good method of fastening a cord in a socket is to cut half of the conductor away, twist the remaining strands into a little cable and then make it up about the screw. Tape should be applied as shown in the illustrations.

Cincinnati, Ohio. C. BROADHURST.

INSPECTING INACCESSIBLE PLACES WITH ELECTRIC LIGHT AND OPTICAL AIDS.

The inspection of a well 1400 ft. deep with the aid of electric lamps and a pair of binoculars, as was done at Galva, Ill., recently, calls attention to the numerous useful applications of a pair of high-power glasses to save labor and reach inaccessible places. In this instance the deep well had been delivering water of bad quality, so the waterworks superintendent lowered a cluster of lamps into the bore, meanwhile inspecting the wall from the surface as the lamps were being lowered. At the 110-ft. level, where the 12-in. casing was reduced to 9 in. in diameter, it was at once seen that the packing was loose so that ground water was entering. Once located, the matter of repair was relatively easy.

In making tests of high-tension transmission lines it is often desirable to measure the current actually flowing in the high-tension conductors. Properly insulated from ground, an ordinary ammeter can be used for this purpose, but for reasons of safety the instrument should not be approached too closely. In testing out a 110,000-volt system, the pressure of which was raised 25 per cent above its normal value, the binoculars once again proved most handy. The ammeter wires were spitting corona viciously, but with the aid of the glasses the observer stood on the opposite side of the room and read the pointer accurately.

To inspect insulators and line construction a pocket glass will save much climbing of poles or towers. A conductor down on the ground can be seen miles away across open country. An aid to estimating distances in this case is a pair of spiders' webs stretched across the field of view in the focal plane, the interval between the cross-hairs being made such as to subtend a man's height, say 6 ft., at a known distance—half a mile or a mile. A man, a house, a window or a door can be picked up in almost any landscape, and by this rough stadia method the distance can be approximately measured. The switchboard attendant will sometimes find binoculars useful in reading the instruments on a direct-current switchboard across the room and at another level, ordinarily entailing a trip downstairs. Float levels in forebays can also be arranged to be visible from the power house, being read with the binoculars as easily as by dispatching a man up to the gage itself, thus permitting closer tab to be kept on the head-water level with considerable less effort.

Chicago, Ill. J. L. JOHNSON.

TEST-BOARD PROOF AGAINST CROSSES OR SHORTS.

On to the test terminals of the board shown 110-volt alternating current or 110-volt, 250-volt and 500-volt direct current can be thrown without any possibility of short-

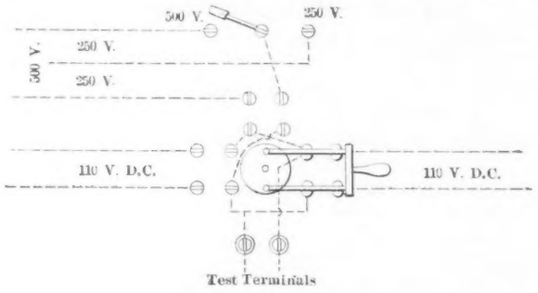


Diagram of Connections.

circuits or crosses between the several sources of supply due to manipulating improper switches. The three-way, double-pole knife switch is mounted on a pivoted turntable of switchboard marble, like the rest of the panel, and each jaw closes into a pair of contact clips, the hinge terminals being connected to the test clips as shown. Under no conditions, of course, can the switch be closed on to more than a single live circuit. The sketch also reveals means for getting one or both sides of the 250-500-volt three-wire system by manipulating the single-pole knife switch at the top. The turntable switch scheme has a number of similar test-board applications, and while not difficult to construct, its use will be found to save much wiring complication besides insuring "foolproof" operation.

Fitchburg, Mass. M. C. RICE.

TESTING MAGNET COILS FOR SHORT-CIRCUITS.

The scheme used at the repair shops of the Cincinnati Traction Company to test motor-field and other coils for short-circuited turns consists in linking the open coil with a magnetized iron core, as shown in the sketch, in this way forming of the suspected coil a transformer secondary.

Local currents will then flow in any short-circuited turns, and the existence of these faults will be indicated by the increased current taken by the core-magnetizing windings, as well as by the development of heat in the coils themselves.

The sketch shows the construction of the three-pole lami-

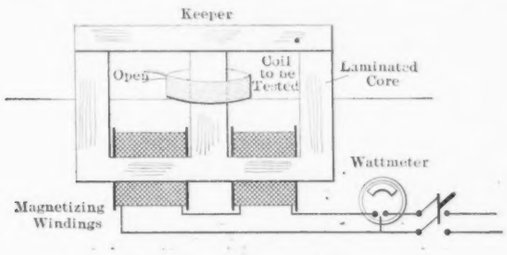


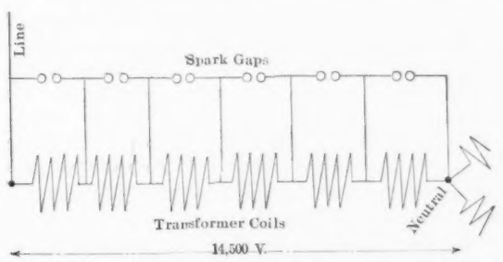
Diagram of Connections.

nated-steel core used. The keeper with which the magnetic circuit is completed is made removable, its weight alone when in position holding it in ample contact with the planed surfaces of the leg laminations. By experiment the exciting energy taken by the core alone or with an open-circuit coil is known from previous determinations. Then if, with a suspected coil under test, the wattmeter indicates an amount in excess of this value, the faulty coil is left in place on the core until the short-circuited windings reveal themselves by heating. In this way the fault can be accurately located and repaired.

Covington, Ky. L. J. TODD.

BRIDGED SPARK-GAPS PROTECT TRANSFORMER COILS.

Much trouble was formerly experienced on the transmission line which connects St. Paul, Minn., with the Somerset (Wis.) water-power plant of the St. Croix Power Company, due to transformer coils puncturing and burning out. With the occurrence of lightning discharges the end turns of the coils would break down, although the damage was usually localized there. Attempts to provide increased insulation at these points availed nothing. It was noticed that either the coils nearest the line side or those nearest the neutral tie were most affected, the middle sections rarely suffering. Further observation showed, too, that the line-side coils usually stood the brunt of the damage. The transformers were 500-kw. six-coil units, star-connected as shown in the sketch, with 8000-volt primaries and 14,500-volt secondaries arranged to give a delta pressure of 25,000 volts. At the suggestion of Mr. F. R. Cutcheon, electrical superintendent of the St. Paul Gas Light Company, and Mr. John Pearson, superintendent of the St. Croix plant, the experiment was finally tried of connecting lightning-arrester spark-gaps across the coils as shown, using five-



Bridged Spark Gaps to Prevent Rupturing of Transformer Coils.

gap arresters to bridge each 2400-volt interval. These gaps are set to discharge just above the normal working pressure on the coil. Use of the arresters after several years' experience has proved the practical solution of the former trouble from puncturing. Any potential that accumulates across the initial coils is discharged by the gaps before its pressure can rise to a point to rupture the insulation. Proof of this protective action is given by the sparks which from time to time are seen to pass across the outside gaps, while the remainder of the group is silent.

Minneapolis, Minn. L. N. PARSHALL.

EDUCATING FIREMEN

A manager of several small central stations has formulated the fire-room hints given later as the first step in the education of firemen along with the introduction of premiums for coal saving. These hints are by no means intended to be "all-comprehensive," but are simply intended as the first step in the education of the class of men who have known but little about the essentials of fire-room economy. It is thought that some brief suggestions of this kind posted in the boiler room will do more good as a start than elaborate instructions or dissertations on the theory of combustion. It is expected to follow this later with such further suggestions as experience with this first set of hints seems to make desirable. The hints are given verbatim as follows:

"Look out for big air holes through your fire. Keep an even bed of fuel.

"It takes air to burn coal, but more than enough air let in through big holes in the fire or cracks in the boiler setting simply takes up the chimney the heat which should be going into the boiler to make steam. Keep the air going in fine streams through every square foot of your fire so that it will burn the coal instead of acting simply to cool down your furnace.

"Close the stack damper, when fire doors are open, as far as you can without getting smoke out of the fire doors. The less cold air rushes in under the boiler when the doors are open the less heat you will lose.

"Look out especially for air holes along sides of furnace and back at the bridge wall, as they are frequently unnoticed at such places.

"Do not throw fresh coal over the whole grate at once. Fire only one-half to one-eighth your grate at once. Covering the whole fire with fresh coal makes lots of smoke, helps to clog up flues and carries a lot of unburned gas up the chimney which ought to be burned for the purpose of making steam.

"Regulate your draft with the stack damper."

While the substance of the above may be given in more polished language or in the vernacular of the boiler room, the instructions should be specific, unambiguous and to the point.

Chicago, Ill. CHARLES R. JAMES.

NEW TYPE OF DISTRIBUTING SWITCHBOARD FOR IMPROVING THE CONSUMER'S LOAD-FACTOR.

Consumers having a number of small motors for individual drive, as for example in machine shops, and who buy energy on the maximum-demand system, find the cost per kilowatt-hour high, as their connected load is large in comparison with their kilowatt-hour consumption. To overcome this difficulty a retired implement manufacturer designed a type of switchboard with a view not only to provide for the proper operation of the various shop circuits but also to meet especially the conditions of the system for charging on the maximum-demand system which is in vogue in his community.

The shop in question is a modern fireproof one-story structure, built of concrete and steel throughout. It is equipped with the latest machines and tools, including upright drills, lathes of different types, universal milling machines, emery wheels, etc. All of the machines are individually driven either by direct connection or link belt.

Each of the various motors has its own separately controlled circuit from the switchboard, a diagram of which is shown herewith. The total connected load is 33 hp, while the largest motor used is a 10-hp machine driving an engine lathe.

The company furnishing energy to the shops charges a maximum rate, and the 10-cent, 5-cent and 3-cent rates are applied. The maximum demand is taken as a definite percentage of the connected load which the consumer can

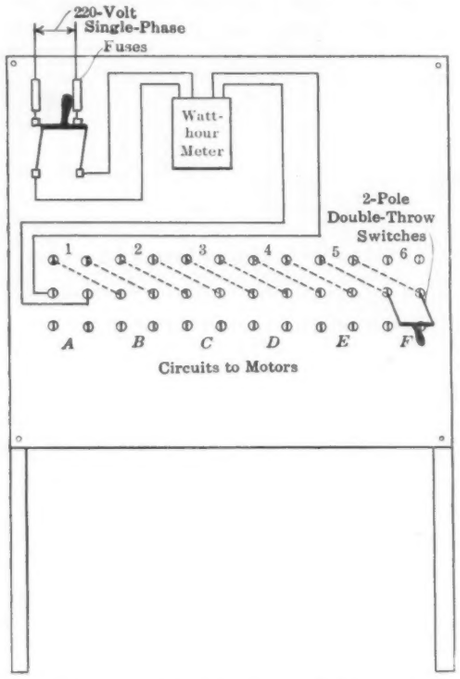


Diagram of Distributing Switchboard.

make on the line at any one time. A study of the diagram will show that only one motor can be used at any one time, the switches and wiring being so arranged that only one motor circuit can be supplied with energy at a time. The maximum is therefore estimated on a basis of 10 hp instead of 33 hp.

The method of working the board is as follows: If, for instance, it is desired to use motor circuit *E*, the two-pole switches 1, 2, 3 and 4 are thrown up and switch 5 is thrown down on circuit *E*. The operation of this board is very satisfactory in this case and would work very well in other shops where individual drive is used and where only one or two men are working. The arrangement of the board could be easily modified so as to permit two or three motors to be used at a time.

This design of the switchboard represents a saving of 50 per cent on the bill for energy, which soon paid for the installation.

Kankakee, Ill. GUY R. GROVE.

DOMINANT FEATURES THAT GOVERN POWER-STATION LOCATION.

A general inspection of nearly every large power station and its various adjuncts will reveal the fact that certain important details have an important bearing upon future operation and have usually not had the attention to which a proper regard for economical considerations justly entitles them.

To generalize, the matter of fuel supply, the source from which it is derived, the avenues through which it arrives, whether competitive or non-competitive, the method of handling it and the facilities for storage after its arrival, the source, character and facility with which boiler-feed water is obtained, considerations of the same kind relative to water for condensation, an ample area for the cooling of condensation water in case it is deemed advisable to use it more than once, are all matters that will have weight with the man who decides upon the best location of a power station if he is to conserve his own interests or the interests of his employers to the best possible advantage.

The sources from which coal is received are a matter that does not usually admit of undue consideration. It will therefore be conceded that the point of origin and the point of consumption are geographically as closely connected as other fixed conditions will permit.

The avenue through which coal arrives has regard for the topography of the country in so far as terminal facilities are concerned. If delivery is by rail the terminal facilities of a particular railroad may be such that the cars could be trestled sufficiently high from the railroad grade for subsequent delivery to the power station to be effected by allowing the coal to pass by gravity from a higher point to a lower point without the expense and trouble of employing hoisting apparatus.

It is important by all means to locate the station so that service can be had from two railroads at least. Competition is healthy, but this is not the sole consideration, as the very best railroads have interruptions in their service which may be due to any one of a dozen different causes. A location on a waterfront with railroad service is also a desideratum when this can be secured without sacrificing other points that are paramount.

No station can be considered modern that fails to provide for storage facilities which will enable it to continue in operation for a period of six months during a break in the regular arrival of fuel supply. In this connection too much emphasis cannot be given to the statement that it is of the highest importance to have facilities for rehandling coal that has been dumped on the ground, and this must be done without having recourse to the tedious and expensive old-time method of shoveling.

An instance of the latter kind came to the notice of the writer during a period of congested coal movement, when it became necessary to shovel coal from the boiler-room level on the first floor, consecutively from one staging to another, up four flights and to pass it over the top of a gondola car that stood on the trestle overhead for its reception and movement to a twin station in the same yard. It probably cost $20 per car to render the manual service connected with this transaction, while with suitable hoisting facilities the energy taken from the switchboard would probably not have cost over 20 cents.

Water for boiler feel and water for condensation may be treated together as far as the character of the water is compatible with desired results, it being understood that river or lake water not overladen with calcium salts may be available at one point, while at another point water of the last-mentioned kind only is obtained as a result of well driving. Every watt-hour that is taken from the busbars for the operation of auxiliary devices, whether it be the energy absorbed by a spray cooling system, by the elevation of coal or by anything else that appertains to an unfavorable location, detracts in an important measure from efficiency.

The disposition of ashes is a matter that frequently does not receive any large amount of attention at the time that the matter of a favorable site is being considered. It, however, frequently presents difficulties of considerable magnitude as time goes on, and the elimination of such items of expense should be borne in mind and weighed against apparent advantages at the time a location is being considered. All advantages and disadvantages should be carefully considered and an effort made to approximate Kelvin's law, which holds in this particular matter with the same force that it does in regard to the economic cross-section of copper used.

North Adams, Mass. T. H. REARDON.

Questions and Answers

Where can I find information regarding the history of electrical development beginning with an account of the earliest station put in operation by Mr. Edison? R. R. H.

An excellent outline of the history of electrical development in America was given in the thirtieth anniversary number of the *Electrical World,* issued on March 5, 1904. A considerable amount of information on this subject can be obtained from the 1902 and 1907 reports on "Central Light and Power Stations" of the Bureau of the Census, United States Department of Commerce and Labor, Washington, D. C.

In attempting to operate a vibrating coil of an ignition set from a 110-volt direct-current generator it was found that connecting a 32-cp, 110-volt lamp in series with the coil did not produce the desired results. Can you suggest a better arrangement? A. H.

A convenient method for reducing the emf obtainable from a generator to a value suitable for use with a low-voltage vibrating coil of a gasoline engine is to connect a resistor across the leads of the generator and connect taps to this resistor so as to obtain whatever voltage is desired at the coil. The resistor circuit could conveniently be made up of several lamps of large candle-power connected in series, taps being taken across one of these lamps to the vibrating coil.

Having at hand water falls rated for development at 100 hp., it is proposed to supply energy to a nearby town of 350 inhabitants and erect a transmission line through a farming community where about twenty farmers will buy energy and operate a 25-hp motor at about 10 miles from the generating station. What type of equipment should be used? H. B.

For transmitting energy over a distance of 10 miles the emf should be about 10,000 volts, and for motor service it is preferable to employ a three-phase circuit rather than a single-phase circuit. Even though as much as 100 hp would be transmitted, the advisability of erecting such a transmission line would be subject to some doubt from the point of view of the financial returns.

In a four-wire, three-phase system where motors are operated at about 220 volts three-phase and the lamps at about 125 volts between the neutral wire and the three outer leads, it has been found economical to use one single-phase meter to measure the energy used by each motor, the meter reading being multiplied by three to determine the energy consumption. In certain cases it has been found that the meter runs backward, when the motor is operating without load. Please state the causes for this performance. B. M.

It is probable that the lighting load is unbalanced to such an extent as greatly to distort the voltages impressed upon the motor. When the voltages are distorted the loads on the motor phases become unequal, and with sufficient distortion the load on one phase may decrease to zero and even assume a negative value.

What is the best method for loading a single-phase or three-phase motor for testing under service conditions? W. T.

The most convenient method of testing a motor of any type is to cause it to drive a direct-current generator, the output load of which can be determined by electrical instruments, and the losses of which can be calculated. The output of the motor then equals the sum of the generator output and losses. Where possible, it will ordinarily prove convenient to cause the electric generator to feed energy back into a direct-current supply system, in which case the method of test is identical with the one that has just been noted.

Kindly give a rule for determining the size of wire for use with a circuit distributing energy over short distances to three-phase motors. L. R.

The exact formulas for such a calculation would involve the relation between the diameter of the wire and the distance of separation between the wires, the frequency, the load rating of the motor, the efficiency and the power-factor of operation. However, a fairly accurate method is one which tacitly assumes a certain value of power-factor and ignores the other differences between direct current and alternating current. If the power-factor were unity, each of the three wires should have a cross-sectional area one-half the area of one of the two wires required for an equivalent direct-current motor, thus requiring a total of three-fourths the amount of copper needed for a direct-current machine. The use of exactly the same total amount of copper for the alternating-current as for the equivalent direct-current motor would be justified if the power-factor were equal to 75 per cent, which is a reasonable value for many installations.

The statement is sometimes made that the voltage at the distant end of a transmission line is greater than that at the generating station. To what may this result be attributed? F. J.

In long-distance circuits the inductive reactance component of the local circuit impedance is very large in comparison to the resistance. Any current passing through this inductive reactance will produce a local circuit voltage which is in time-quadrature to the current. When the current is in leading time-quadrature with the voltage at the generating end, the voltage along the circuit, which is in time-quadrature with the current, will be in additive time-phase with the generator voltage, and hence the resultant terminal emf will be greater than the emf at the generating station. The charging current of a transmission line which is proportional to the product of the length of circuit and the circuit emf becomes very large in extremely high-voltage long-distance transmission systems, and this current is in leading time-quadrature with the voltage between the transmission wires.

It is desired to utilize certain 133-cycle transformers now on hand at 60 cycles, and to transfer certain 60-cycle transformers to 25-cycle service. Can these changes be made without damaging the transformer? C. R.

The limit to the output of a transformer is determined by the heating. A transformer designed for operation at frequency of 133 cycles will be subjected to increased iron loss if operated at the same voltage with a frequency of 60 cycles. The flux in the core would be increased in the ratio of 1 to 2.2. However, the frequency is decreased to 45 per cent of its former value. The final result is that the loss in the iron is increased by 60 per cent. If the transformer is operated under conditions producing such an increase in iron loss, it should not be subjected to its normal heating in its coils. The current in the coils should be decreased to 63 per cent of the value which was permissible when the unit was operating at 133 cycles. Although it is not usually convenient to do so, if the voltage per turn to which the primary coils are subjected is decreased to 74 per cent of the value employed with 133 cycles, the iron loss will be the same when used at 60 cycles. So far as the losses are concerned, the conditions when substituting 25 cycles for 60 cycles are very similar to those when substituting 60 cycles for 133 cycles. However, the numerical values are slightly different. If the voltage is not changed, the current output should be decreased to 56 per cent of the former value, while if the current output is to be retained at its former value, the impressed voltage should be decreased to 72 per cent of the former value. Although in substituting 60 cycles for 133 cycles no attention need be paid to any condition other than the losses, such is not likely to be true when a frequency of 25 cycles is substituted for one of 60 cycles. When operating at either 133 cycles or 60 cycles the exciting current will be inappreciable, but at 25 cycles the exciting current may become quite large. On this account, it would ordinarily be preferable to lower the voltage when the intention is to substitute 25 cycles for 60 cycles.

Central Station
Management, Policies and Commercial Methods

CENTRAL-STATION GROWTH AT FORT WAYNE.

During the months of January and February, 1912, the new business closed by the light and power department of the Fort Wayne & Northern Indiana Traction Company, of which Mr. J. B. Weidgenant is sales superintendent, showed an increase of 204 per cent over the corresponding gain during the first two months of 1911.

DRAINAGE PUMPING WITH ELECTRIC MOTORS.

Contracts have been closed by the Kansas City Electric Light Company to furnish energy for operating a pair of 30,000-gal. centrifugal pumps used to free the bottom-land portions of the city of water in time of flood. Each pump will be driven by a 250-hp motor, and on account of the intermittent use of these units 5 cents per kw-hr. is to be paid for all energy consumed.

ELECTRIC POWER FOR MILLING MACHINERY.

The Kentucky Electric Company, of Louisville, has obtained the exclusive contract for furnishing light and power for the exhibit of machinery which will be a feature of the annual convention of the Fraternity of Operative Millers of America, to be held in Louisville the first week in June. The exhibition will be held in the First Regiment Armory, the exhibit hall containing 50,000 ft. of floor space. All of the exhibits will be motor-driven.

ADVERTISING PORCH LIGHTS.

To educate and interest the residence consumer of electrical energy in the advantages of a special night service for exterior house use, the Southern California Edison Company, Los Angeles, has issued an attractive and effective card for inclosure with bills, as shown in the accompanying illustration. As will be seen, its message is centered in "protection at low cost." While the customary 16-cp lamp might have been reasonably advocated, the company recommends an 8-cp lamp at a cost of but 60 cents per month as sufficient for the purpose.

CENTRAL-STATION EXHIBIT IN PARADE.

In an industrial parade held in a Middle West city not long ago the central station was represented by one of its battery-driven trucks carrying a jig-saw operated by a motor which received its energy supply from the truck battery. Toy animals had previously been outlined on boards of thin wood, and these the operator on the truck sawed out, dotting in the eyes and tossing them out to children in the crowd. The truck carried a sign detailing the extent and uses of motors in the city, and it proved to be one of the features of the parade.

METER ACCURACY AT DAYTON, OHIO.

The Dayton Lighting Company, of Dayton, Ohio, has recently completed a series of tests on 5554 meters in service on its lines, covering a period of two months. Under full-load conditions only 6 per cent of the total number of meters tested were found to run at more than 104 per cent normal speed and 11 per cent were found more than 4 per cent slow. The meters found within 4 per cent of correct registrations were over 82 per cent of the total number tested. On light load (that is, a load of 10 per cent) 8 per cent of the total number of meters tested were over 4 per cent fast, while over 23 per cent were over 4 per cent slow. Of the total number of meters tested, 68 per cent were within 4 per cent of accuracy. In the range between 99 and 100 per cent accurate fell 23 per cent of the meters under full load and 20 per cent under 10 per cent of full load. The results of the tests were in general very good and reflect credit on the method of the Dayton Lighting Company. They are published through the courtesy of Mr. O. H. Hutchings, superintendent.

ELECTRIC SERVICE IN HAMILTON, ONT.

The accompanying illustration shows a button got out by the commissioner of industries of Hamilton, Ont. From the electrical design in the center of the button it will be noted that the commissioner has paid a compliment to the Hamilton Electric Light & Power Company, for while Hamilton is a city of 400 industries, it would appear that the low rate which prevails for industrial service is the big inducement offered to manufacturers. To be sure, Hamilton has many other inducements, but the opportunity of obtaining abundant electrical energy at very low rates is, no doubt, one of the biggest. As is probably well known, Hamilton has been dubbed "the Electric City of Canada." Mr. Thomas F. Kelly is the enterprising contract agent of the company.

ICE PLANT IN CENTRAL-STATION DISPLAY ROOM.

To the myriad of articles and appliances which are appropriately displayed in a central station's exhibit room the Kansas City Electric Light Company has added a small motor-driven refrigerating outfit in operation. The expansion coil for the compressed ammonia is provided by a ¾-in. lead pipe bent to form the script letters of the words "Electric Ice," against a 12-ft. by 4-ft. black background, hung on the opposite side of the room. The railing about the machine is also connected to the ammonia line so that it, like the lead-pipe coil, is covered with a thick layer of clean white frost while the compressor is in operation.

SIMPLIFIED CONTRACT FORM FOR DIVERSIFIED SERVICE.

The Licking Light & Power Company, of Newark, Ohio, has devised a simple form of contract, which while covering a specific service also serves to cover diversified services subject to different rates. Where a central station furnishes energy for various uses and at different rates it is customary to have a separate contract form for each class of service. This need has been obviated, however, by the use of one form on which the statement is made that "Applicant agrees to pay company monthly for the service rendered at schedule rate No. —, as it appears in published rate schedules of the company, which, with the rules and regulations appearing therein, are made a part of this contract."

The publication referred to consists of a small book containing the rules of the company for its customers, various rates for all classes of service, each bearing a number, and prices of incandescent lamps. By this scheme one contract

form only is necessary for all customers and assurance is had that each one has at least secured a copy of the company's rules and regulations.

FILLING UP THE NOON VALLEY.

To the central station which has developed its day load of motors well up to the level of its evening peak comes the problem of reducing the slump in the load curve which each day's noon hour brings. One company has succeeded in getting a couple of its large factory customers to shift their lunch hours by about thirty minutes, with the result that their motor loads are kept running during the period when most of the other factories are shut down. This overlap eliminates the sharp dropping off in the load formerly experienced, and while the noon valley is broadened accordingly, in no place does it remain as deep as formerly.

To the same end, sales efforts have been successfully applied to getting electrically heated cooking appliances installed in the restaurants and lunch-rooms in the business district. The existence of this demand at the noon hour has had an appreciable effect in helping to fill up the 12 o'clock slump, and further installations of this kind are being encouraged. The company's engineers are also on the lookout for such off-peak heating loads in industrial lines, and for any load whose demand can be limited to the noon period they are prepared to offer a very attractive rate.

CLEVELAND WINDOW DISPLAY.

As a part of its campaign of education in the use of electrical devices, the Cleveland Electric Illuminating Company had a display in the window of its general sales office last week which attracted much attention. It is said to be one of the most artistic windows ever seen in the city. The display was in the form of an arbor, the walls being covered with grass plumes, and the roof with southern smilax, with illuminated flowers woven into it. The floor was of green moss. A basket of pink illuminated roses hung from the roof at the right and pots of illuminated flowers rested here and there on the floor. The striking feature of the display, however, consisted of a dozen or more dolls or manikins in characteristic positions manipulating various electric devices. Among them were a coffee percolator, an egg boiler, a chafing dish, a pancake griddle, a radiator, a cigar lighter, a steak and chop grill, a shaving mug and a samovar.

An evening view of the Cleveland harbor was also shown. In this the lights at the head of the breakwater are operated automatically and all the downtown buildings may be seen with windows ablaze with lights. The effect is excellent and the display served to attract the attention of thousands of people.

A YEAR'S HOUSE-WIRING CAMPAIGN AT KANSAS CITY.

During the first 365 days of the Kansas City Electric Light Company's house-wiring campaign, completed this month, 607 old houses were wired under contracts turned in through the company, while 250 others were handled directly by the contractors as a result of the interest created. Only thirty-two out of this number required line extensions, and in some cases four or five houses were reached by a single run. None of the extensions exceeded a block in length or cost more than $100. The average cost of wiring the houses was $48, and the total increased business connected represents 11,472 16-cp equivalents. Four men have been employed during the campaign, which is under the direction of Mr. C. F. Farley, contract agent.

To stimulate employees' interest in the rapid increase of lighting and motor business now being taken on, the Kansas City company has offered as prizes several trips to the Seattle N. E. L. A. convention, with all expenses paid. The motor-service salesman closing most business in the final three months will receive one of the prize trips, and the employee of the company, outside the contract department, bringing in the greatest number of house-wiring contracts will also get a Seattle trip. The motor-service sales department of the Kansas City company, which is in charge of Mr. H. A. Glass, closed 2000 hp in contracts, divided among nearly 100 new customers, during the month of March.

THE ELECTRIC VEHICLE IN LOUISVILLE.

Plans for an electric vehicle show, to be restricted to cars of that type, are being made by the Louisville Electric Dealers' Association, of which Mr. E. G. Reimers is president. The plans of the association have not yet assumed definite shape, but it is believed that the show will be held in the First Regiment Armory in Louisville some time during the fall. Mr. Lee Miles is vice-president of the association and Mr. Carl G. Reimers is secretary and treasurer.

The organization has adopted a schedule of rates for garaging and charging electric cars, as follows: Victorias and small open cars, not less than $25 a month; coupés, roadsters and closed cars, not less than $30 a month; commercial cars and trucks, not less than $35 a month. For dead storage on cars the rate is not less than one-third of that for live storage and $1 per charge for all energy used while batteries are on storage. The rate for dead storage on batteries only is not less than $5 a month and $1 per charge for all energy used while batteries are on storage. Dead storage on cars without batteries is at the rate of not less than $8 a month.

The rates for charging and cleaning are as follows: One charge, pleasure cars, not less than $1.50; commercial cars, not less than $2; washing and polishing, all cars, not less than $1; washing batteries, not less than $1 per cell.

A feature of the association work is an agreement whereby the garages assume no responsibility for damage to cars from fire, water, cyclone or other accidents. The garage owners have caused themselves to be constituted the servants of the owners, so that the insurance policies held by the owners continue in force while the cars are in the garages.

SOLICITING ON TERMS OF SERVICE, NOT CHEAPNESS.

"As venders of electric illumination steer clear of the word 'cheap' and the entire thought association going with it," were the words of Mr. Norman Macbeth, of the Westinghouse Lamp Company, Bloomfield, N. J., in a discussion of "Competitive Illuminants" before the Minnesota Electrical Association, March 22. "Capitalize value—service. Make it inexpensive if you will, worth more than it costs, but never cheap," added the speaker. "The good kind of gas illumination is not cheap nor is it always unsatisfactory. The general public with whom you deal may not know of this better kind of gas illumination, and it can properly be considered within the province of the gas man rather than the electric man to promote that education.

"If cheap illumination is the gas man's burden, do you want to share it?" questioned Mr. Macbeth. "There is perhaps no one phrase or idea that is giving him as much trouble. Don't fight the cheap argument—agree to it, other-

wise you will help the gas man to clear himself of his pet phrase.

"To say that your electric service is as cheap as gas is going against the belief of the general public and is invariably an invitation to a discussion in which you may have little to gain. Consumers want good service and they are willing to pay all that you in reason will demand of them. They will give you an opportunity to prove that good electric lighting is no longer prohibitive in expense and, considering convenience, comfort, up-to-dateness in the eyes of their neighbors, etc., is easily worth all that it costs. When you make the statement that electricity is as cheap as gas, remember that you are going down to the gas man—lowering your product or elevating his, as your prospective customer may decide. Unquestionably there are many points in electric service which a gas installation does not and cannot afford. Your consumer expects to pay for these advantages. Tell him what they are, capitalize them, make them worth while, worthy of his possession."

WIRING CAMPAIGN IN PITTSBURGH.

The accompanying illustration, taken from a recent issue of the *Pittsburgh Gazette-Times*, forms part of the campaign inaugurated by the Allegheny County Light Company for wiring old houses in Pittsburgh and the surrounding territory supplied from its circuits. The advertisement speaks for itself and emphasizes the fact that the wiring of old buildings does not entail the defacement of walls, ceilings, etc. Moreover, the company draws attention to the necessity of having the work well done, in order to protect owners and tenants against fires due to careless and defective wiring.

Special Electric Wiring Offer

¶ We will wire at cost until July 1, 1912, all houses and stores now completed and within reach of our lines and will allow this to be paid for with a small amount down and the remainder in 12 equal monthly payments. This special offer does not apply to houses now being built or to be built.

¶ We will also provide, when desired, all necessary electric light fixtures at wholesale prices and arrange for payment on the same easy terms as for wiring.

¶ We will wire your house or store for one light or 10,000. We will wire for a single outlet that you may use an electric vacuum cleaner, an electric washing machine, an electric sewing machine motor, or an electric smoothing iron, although any of these labor-saving household appliances may be attached to any electric light socket. We will take as much care and pains to do the work well for a single outlet as for 500.

¶ This wiring will be done by first-class workmen only. They will wire houses to give owners absolute safety and the greatest efficiency at the least cost. They will have the advice and co-operation of our illuminating engineers in the arrangement of lamps to give the best possible illumination for the least outlay. In wiring old houses no damage will be done to ceilings, wall paper or wood work, as only workmen who are careful, tidy and skillful are employed.

¶ You cannot afford to run the risk of fires due to careless and defective wiring. You want it to be safe and remain that way. So do we. We are vitally interested. Bad wiring gives an electric light company no end of trouble. We demand the best work first-class workmen can do. Our interests are mutual.

¶ No house is modern that is not wired for electricity. Those who intend to move should see that the house they propose to rent is wired before they sign the lease. Prospective tenants should induce prospective landlords to accept this special offer at once, as the rush is already beginning to tax our wiring force, large, efficient and well organized it is. This special offer is good until July 1, 1912. Don't delay and let others crowd you out.

¶ Call **898 Hiland**, Wiring Department, and have one of our experts examine your house and give you an estimate of the cost of your wiring. His services are free.

ALLEGHENY COUNTY LIGHT COMPANY

435 Sixth Avenue, Pittsburgh.

Newspaper Advertisement in House-Wiring Campaign.

LOOSE-LEAF DIGEST FOR COMMERCIAL MEN.

In various directions the Commercial Section of the National Electric Light Association is manifesting commendable activity and enterprise in preparation for the Seattle convention. One of the most interesting and valuable of the features to be presented at the convention by the Commercial Section—a feature of which it is appropriate to say something at the present time—is the "Commercial Section Loose-leaf Digest," which will be a book of between 250 and 300 pages of the size of the N. E. L. A. *Bulletin*, to be distributed to all members of the Commercial Section of the association. The sheets composing this digest will be in the loose-leaf form fastened together by metal rings, so that additions may be made in the future.

The digest is to be divided into two parts. One of these will give practical data of the consumption of energy and other useful facts in relation to various motor and lighting installations. The arrangement will be alphabetical. Under "W," for instance, will be sheets devoted to wood-working establishments where electric drive is employed. The name of the concern using electricity, the character of equipment, the actual consumption of energy by months, and much practical and valuable information of this character, will be given, the whole of this part of the book forming an extremely valuable mass of data for the guidance of solicitors in the new-business departments of electric-service companies. In talking to a man who runs a feed mill, for instance, the solicitor can show just how much Mr. Smith, of Blankville, who runs a feed mill of about the same size in another town, pays for the electrical energy he uses. Such practical arguments as these are very convincing with prospective customers, and it is felt that this feature of the book will be especially helpful.

The other part of the book will be devoted to digests of articles in the technical press relating to industrial installations. A great mass of extremely valuable information of this character has appeared in the *Electrical World* and other journals, and in the Commercial Section Digest this information, for several years back, will be presented in brief abstract form so that it may be readily available.

The committee in charge of the preparation of the "Digest" consists of Mr. E. L. Callahan, of Chicago, chairman, and Messrs. T. I. Jones, of Brooklyn, and E. W. Lloyd, of Chicago. The book will be distributed on all the special trains going to the convention. It is, however, a Commercial Section product, and will be handed to the members of the Commercial Section only. Other members of the N. E. L. A. desiring to have the book can obtain it, and also the other benefits of belonging to the Commercial Section, by paying the small fee necessary to become a member of the section, and this may be done while on the train so that the book may be studied on the way to the convention. In this way it is believed that a number of new members for the Commercial Section will be obtained, and there are already evidences that there will be keen rivalry on the various trains to report the greatest number of accessions to the Commercial Section on arrival at Seattle. All new members of the Commercial Section joining on the trains, or before that time, will have all the privileges of older members at the Seattle convention.

ELECTRIC ICE MAKING AT GENEVA, NEB.

The ice factory at Geneva, Neb., purchases both its power supply and its distilled water from the Geneva Electric Company, whose 225-kw non-condensing engine-driven plant is located two blocks from the ice factory. A 25-hp motor drives the ice machine, which has a capacity for producing 6 tons of ice daily. The electric-light plant is

operated eighteen hours out of the twenty-four and pulls the ice factory during five or six months of the year, receiving $2 for each ton of ice made.

The condenser cooling water used in the ammonia coils is purchased from the city at a cost of $10 a month, and after serving its purpose in the ice factory is delivered to the steam plant for boiler-feed purposes and for condensing the engine exhaust collected for distilled-water ice making. As the electric company pumps the city supply on a flat-rate contract this practically amounts to having the central station provide its own water supply. One 150-kw and one 75-kw engine-driven unit are in service at the electric plant, and the exhaust from these is collected in a special condenser arranged with a series of baffle plates which cause the water to be reboiled on its way out from the point where it is condensed. An automatic pump delivers this distilled water through a pipe to the ice plant.

Rough tests made by Mr. G. S. Sprague, superintendent of the Geneva plant, show an average demand of 25 kw taken by the refrigerating load. This demand varies little, it depending on whether the compressor is running lightly or heavily loaded, and while in the Geneva instance the ice plant is kept producing the limit of its capacity, the arrangement by which the electric company's compensation depends on the actual ice output might prove unsatisfactory under different conditions. In general a metered rate might be more desirable.

The Geneva plant produces all the ice required in the local community of 1700 people, besides shipping part of its output to nearby towns. Ice is retailed at 50 cents per 100 lb., equivalent to $10 per ton.

The Geneva Electric Company also does a steam-heating business in winter time, so that in conjunction with its ice-factory summer by-product a high annual load-factor is obtained in both its steam and electrical departments.

UNITED ELECTRIC INCREASES ITS ELECTRIC-VEHICLE EQUIPMENT.

The United Electric Light & Power Company, New York City, has just added two 2000-lb. delivery wagons to its electric fleet, the new vehicles being manufactured by the Ward

Lamp-Delivery Automobile.

Motor Vehicle Company. These wagons are for the lamp delivery service and bring the total number of electrics up to twenty-two, as follows: Two 700-lb., four 1000-lb., nine 2000-lb., two 2-ton, three 3-ton, and two 5-ton.

The newer wagons are designed to run from 40 to 50 miles on hard, level asphalt with a full load one-half way. The wheel diameter front and rear is 36. in., and the tires are 3½-in. solid Firestone motor-truck type. Motor, countershaft and wheels are all mounted on ball bearings of large capacity.

The battery is a forty-four-cell "Exide Ironclad," rated at 35 amp for four and one-half hours. The controller is of the continuous-torque type, having four regular running speeds and a fifth emergency speed, with two speeds for reverse. The fifth speed on the controller is designed in such a way that on ordinary level roads a speed of from 8 to 10 miles per hour is obtained with full load, while on the fifth speed a little higher rate is obtained with increased consumption. The resistance, however, with which the controller is equipped is designed in such a way that on a grade there is practically no difference in energy consumption between the fourth and fifth notches. The dimensions of the wagon are: Length, 8 ft.; width, 4 ft.; height, 5 ft.

AN EXHIBIT ROOM THAT CO-OPERATES WITH THE SUPPLY DEALER.

"Nothing for Sale, but We Demonstrate Anything" is the motto of the Cleveland Electric Illuminating Company in its handsome display rooms on Superior Street. Supply dealers and manufacturers are invited to deposit samples of their goods here for exhibition. The displays are in charge of capable demonstrators furnished by the central station, but when a customer expresses a desire to purchase some device he is given a card with the name and address of the dealer handling the apparatus. A carbon copy of this card, on which is added the customer's name and address, is retained by the demonstrator, and at the end of the month these stubs are compared with the originals turned in to the dealers by actual purchasers. The stubs not thus accounted for then provide a "prospect" list to which literature is mailed or personal attention given.

The Cleveland company also offers use of its window space for a week at a time to dealers or manufacturers with novel specialties to exhibit. These window displays are engaged weeks in advance. Featuring the window exhibitions, descriptive articles are used the same week in the People's Electrical Page which now appears in three Cleveland newspapers, and display advertising on the same topic is run by both the electric company and the manufacturer. One novel window exhibit during the week of March 4, for example, was an electrically equipped bed which attracted the attention of crowds outside the window.

This principle of co-operation with the supply dealer on the part of the Illuminating company only bears out the practice of co-operation with contractors established by the Cleveland central station in earlier house-wiring campaigns. By using its appliance rooms for demonstration purposes exclusively, the company gets the full benefit of the popularizing effect of the displays, while avoiding the making of petty sales or incurring the enmity of the supply dealers. From the number of reference cards and inquiry stubs received, each dealer can also gain a definite idea of the value of the exhibit-room display to his own business and is not asked to contribute unless it is to his benefit. Since the electric company makes no direct sales, two well-equipped shops have been opened up in the boulevard section of the city, the business of which is confined wholly to electrical things for the home.

Free telephone service for the public has been a factor in making the Cleveland exhibit rooms popular as a meeting and waiting place. Separate connections over both systems are provided for both men and women, and many visitors drop in to take advantage of this accommodation. In maintaining this service the company believes that each time a customer enters to use the telephone he will learn of new household devices or be reminded to pay his bill promptly.

DISTRICT ELECTRICAL SUPPLY.

Small towns served by the Oregon Power Company from its steam plant at Springfield, Ore., in the Willamette Valley, show a large per capita use of electricity. This plant furnishes electricity for ten towns ranging from 500 to 10,000 population by 70 miles of transmission line. By good service, moderate rates and a live new-business department, the per capita use of electricity has made a remarkable showing for small towns in a farming community.

Junction City, with 759 population according to the 1910 census, has 223 customers, or one customer for every 3.4 inhabitants. Harrisburg with 453 inhabitants has 170 customers, or one for every 2.7 inhabitants. Practically all customers are metered, there being 357 meters in the two towns, or one meter for every 3.4 inhabitants. Practically every house, store and industry is a user of electric light or motor service, the connected load being 248 kw for commercial lighting and 72 hp in motors. This amount of per capita use of electricity is seldom exceeded in the larger towns. This business has been built up through the efforts of the local manager, Mr. H. C. Sutton, who also does all the work in the running of these two properties except the line work, line men being sent when necessary from the larger towns in which the company operates. New business has shown a gain of 500 per cent in connected load in about a year, and a gain in customers of 260 per cent.

Wiring and Illumination

TRANSFORMER HOUSE FOR SMALL-TOWN DISTRIBUTION.

A transmission company distributing electric service to a group of small communities in Michigan has erected transformer houses like that shown in the illustration in each of the towns reached by its lines. Sheet steel is used to form the cylindrical body, which is about 4 ft. in

Transformer House.

diameter and 12 ft. high. The interior is divided into two stories, the lower of which is occupied by the transformers, while the other serves as a local storeroom for supplies, meters, etc., the operating company having no other quarters in the community. A steel roof held clear of the wall by a space sufficient to allow full circulation of air projects with a 9-in. eave, protecting the interior against the weather. As shown, the house is supported on steel angle pieces embedded in the concrete foundation, raising it 2 in. above the floor. The cost of these houses was 6 cents per lb.

DESIGN OF WOODEN SWITCH-BOXES.

By Harry Burrows.

Wooden switch boxes can be readily made. Iron ones are preferable, but their cost is often prohibitive. Wooden boxes (Fig. 1) should be of at least ¾-in. well-seasoned wood and lined with ⅛-in. asbestos, secured in place with screws or with tacks and shellac. Sheet iron of at least

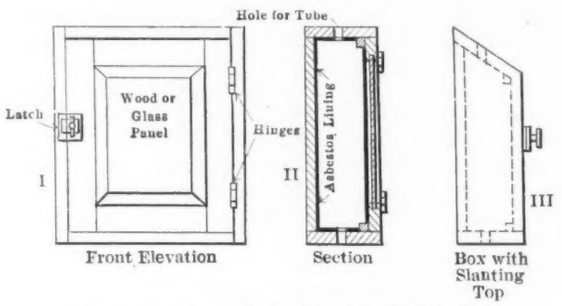


Fig. 1—A Home-Made Wooden Switch-Box.

No. 16 U. S. metal gage may be used instead of asbestos. The door should close against a rabbet so as to be dust-tight. Where a door is wider than, say, 12 in., it should be paneled with either wood or ⅛-in. glass, if of an area not greater than 450 sq. in., to insure against distortion due to warping. A space of 2 in. should be allowed between fuses and the door. A reliable catch should be provided on the door. Porcelain tubes or other approved insulating bushings should be used for reinforcing the insulation on the wires where they enter the box, and these should fit the holes snugly. Where necessary, wires should be taped so as to fill completely the holes in the bushings. Bushings reaching just to the inside of the box should be used, as longer ones will be broken. It is recommended that, for factory use, the top of the box be slanted as at III (Fig. 1), so that it will not be used as a shelf. A box should be thoroughly filled and painted before it is lined.

Several switches, either snap or knife, can be mounted

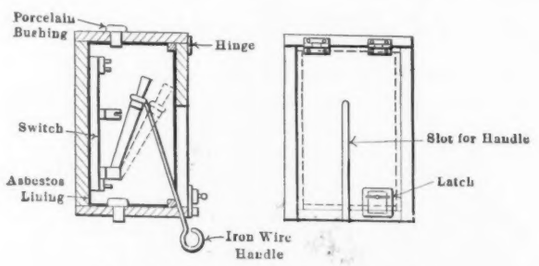


Fig. 2—Inclosed Wooden Switch-Box.

in a box like that of Fig. 1; in fact, it might be used as a panel box. A box or cabinet similar to that of Fig. 2 is often convenient, in that it is not necessary to open the door to manipulate the switch. The heavy iron wire handle can be attached to the switch by bending it around the wooden handle, or the wooden handle can be removed and the wire fastened with a nut or a screw eye. Wooden or composition cabinets must not be used on metal conduit, armored cable or metal molding systems. If the wooden cabinet is lined with sheet iron, the latter must be painted or treated in some way which will prevent corrosion.

GUYED MAST WIRE CROSSING.

BY R. D. COOMBS.

The transmission line of the Public Service Electric Company between Rahway and the new generating station at Perth Amboy, N. J., crosses Woodbridge Creek on State Street, Perth Amboy, and as it is not desirable to use submarine cables passing under the stream in such transmission lines, it was necessary to carry the wires across the waterway at a height of 125 ft. above mean high water, this being the War Department's requirement for this particular location.

The line in question will ultimately consist of 30 No. 2/0 hard-drawn stranded copper, high-voltage circuits, a very heavy and important power service. Since the crossing adjoined a public street and could not be located upon private right-of-way, it became necessary to design the supporting structures with a restricted width at the base and to provide an outline that would not appear ungainly and therefore be objectionable near a public highway.

The economic choice between an all-concrete foundation carried down to a firm bearing and a pile-concrete foundation will undoubtedly depend upon the amount of swamp to be encountered and the extent to which the ground is water-bearing or tidal. In addition, the accessibility for

Transmission Line Crossing Woodbridge Creek at Perth Amboy, N. J.

pile-drivers must be taken into consideration. After careful investigation it was decided to adopt the type of guyed mast shown in the illustration, and it was thus possible to restrict the width at the base to 4 ft.

It has usually been found economical to design comparatively shallow concrete foundations when they are carried upon piles in tidal swamps, and since the source of the ground water is Newark Bay and the foundations are immediately adjoining a navigable stream, the piles will always be in water, though the cut-off is much nearer the surface than in ordinary foundation work. The foundations are supported upon piles driven through the upper swampy stratum to a firm bearing in the clay and sand beneath, and presented no unusual features other than the relative expense of installing a pile-driver for only eight piles.

The crossing span is 322 ft. long, the lowest wires being 128.5 ft. above the foundations, and the total distance between the bottom wires and the ground wire at the top of the masts is 22.5 ft. From the steel masts the wires descend abruptly to wooden poles of moderate height, which are part of the standard line construction. This marked change in the profile of the wires is made possible by the use of special clamping devices and insulator attachments both on the masts and on the next adjoining poles. There is no operating objection to the attachments; in fact, they are readily made of greater strength and electrical conductivity than the standard line construction. The electrical characteristics and physical requirements of the clamping devices, as well as the position and spacing of the wires, were in accordance with the National Electric Light Association's specifications for overhead crossings.

Since first-class galvanizing appears to be as yet the best manner of protecting metal parts immediately adjacent to the line wires, the insulator attachments were galvanized by the hot process. In the design the standard loading, a covering of ice ½ in. in thickness, combined with a wind pressure of 8 lb. per square inch thereon, was used in determining the tension in the wires. In order to ground the steel masts copper plates were buried in the wet earth beneath the foundations, and copper wires leading from these plates were carried up through the concrete and soldered to the bases of the masts.

The work was designed and constructed by the writer's company, under the supervision of Mr. Farley Osgood, general superintendent of the Public Service Electric Company, Newark, N. J.

WINDOW LIGHTING DISCUSSED IN CHICAGO.

At the meeting of the Chicago Section of the Illuminating Engineering Society on April 18, at the Great Northern Hotel, Mr. J. Henninger, of the National Electric Lamp Association, engineering department, delivered a lecture on show-window lighting.

Mr. Henninger called attention to the introduction of the electric incandescent lamp as making possible the development of show-window lighting in a way before not attempted. One of the first results of having a lamp which could be placed in any position around a window was the outlining of show windows with incandescent bulbs. After a number of years merchants began to learn that this was not the most effective way that could be employed in lighting a window.

The intensity of illumination required in show windows depends on the locality and the standard of illumination which prevails in surrounding stores and streets. Much higher standards obtain in some towns than in others. The intensity required is also dependent on the class of goods to be shown and the amount of illumination obtaining in the street.

Mr. Henninger showed some lantern slides illustrating the effect of having large sources of light like flame arcs in front. These interfere with seeing the goods in the window clearly as viewed from across the street. He said that show windows lighted only from lamps hung along the sidewalk outside the show window looked dead and uninteresting. Another view showed the bad effect of glare from a glass window back which interfered with clear vision. Certain windows illustrated contained too much illumination in the top of the window at the expense of the front lower portion.

He went extensively into the matter of window dressing to secure the best effects from contrast. He showed that a single color of window backing of universal application is an impossibility because of the difference of color in goods shown. In one of his examples, where chinaware was exhibited, a black backing was the best, while in a window showing dark goods or shoes light-colored backings were best. One Cleveland store which is noted for its window display carries different colors of window backings for use to suit the kind of goods to be shown. One of the best lighted windows illustrated contained lamps in deep panels or recesses scattered over the entire area of the window ceiling. The light came from so many directions that the effect was excellent. The lamps, however, were not equipped with reflectors, being simply located in box-like

ceiling panels painted white. The result was a low efficiency, as shown by foot-candle measurement taken in the window on a plane 18 in. from the floor. This showed only about 18 ft.-candles with an expenditure of about 20 watts per square foot with tungsten lamps. The efficiency, he said, could undoubtedly be much increased by the use of proper reflectors, and the general effect would probably be just as good under this plan as under the less economical one described.

In discussion Mr. A. D. Curtis gave some reminiscences of the show-window-lighting business. He said that a show window should be lighted like a stage setting for perfect display of the contents of the window with no lamps in sight. He gave theatrical people credit for being the first to appreciate the importance of properly concealing the sources of light if illumination is to be the best for clear vision. Exposed lamps are never used on the stage except when they are considered a necessary part of some scene, and their use in such cases simply serves to bring forcibly to mind the more comfortable vision when no lamps at all are seen.

Mr. Albert Scheible questioned whether from the merchant's standpoint the large arc lamps hung in front of a store were as bad as the lecturer thought, because they attracted people to the sidewalk in that vicinity, and once they were under the lamps there was no further annoyance from them.

Mr. J. R. Cravath indorsed what Mr. Henninger had said as to the importance of proper window backing to bring out the right contrast. He also called attention to the difficulty of properly lighting very shallow windows in which the lamps must be placed at a considerable height above the window. In such windows the light strikes upright objects so obliquely that the illumination on them is very poor, and shadows are bad even though very concentrating reflectors be used. Deep windows in which lamps can be placed low along a transom bar about even with the ceiling of the window can be lighted to the best advantage. Over-crowding of show windows is another difficulty frequently met. This means that the goods frequently cast shadows on each other and on themselves. Deep windows—that is, those in which the depth is from 50 to 100 per cent of the height—are the best both from the window trimmer's point of view and from the lighting man's standpoint.

Mr. Preston S. Millar, general secretary, of New York, suggested that the necessity for contrast did not necessarily mean that the contrast should be strong or violent. Mild contrasts are frequently the most pleasing, especially in the highest class of work.

He suggested as a method of studying the illumination produced by different reflectors in a window that a white sheet be hung so as to occupy about the position of the plane of trim. Then by taking out the milk-glass test plate on a photometer arranged for foot-candle measurement and allowing the light to shine directly on to the photometer mirror or screen the specific brightness on the sheet at the various points could be tested with an observer holding the photometer in the same position at which he would naturally view the goods in the window. This would give directly and easily the information wanted about the relative intensity required.

Mr. Alfred Johnson told of the difficulties of properly lighting show windows in the daytime, especially when there is bright sunlight. About such times the view of the goods is much interfered with by the reflection from across the street which is seen in the plate glass. The proper illumination of show windows at night is easy as compared to this problem, which has practically never been successfully solved.

Mr. Curtis called attention to the fact that wastes of 40 to 50 per cent are very common in show-window lighting, and said that in no other department of the merchandising business is there so much waste going on with so little attempt to stop it.

Mr. T. H. Aldrich divided show-window lighting into two classes, first, lighting for show and spectacular effects and, second, lighting for the display of the goods. For the display of goods unquestionably the best place for the lamps, concealed, is at about the level of the transom bar of the window. He suggested that windows be wired so that two different intensities of illumination may be obtained in order to make more effective the showing of different classes of goods.

In conclusion Mr. Henninger indorsed the idea that the stage-lighting effect should be the one thought in window lighting. He described briefly some very striking effects obtained by use of flashers, flashing on and off colored light so as to bring out the different colors of the goods that were on display.

Letter to the Editor

SHOW-WINDOW LIGHTING.

To the Editor of Electrical World:

Sir:—The discussion recently held at the Chicago meeting of the Illuminating Engineering Society on show-window lighting was very timely, in view of the important place this class of lighting has in the illuminating field. Properly lighted show windows are important factors in modern merchandising and also an important source of revenue to electric companies. They offer to electric companies a very substantial class of business which should extend late into each evening and with proper encouragement should be kept on every night of the year. Window lighting has sometimes been divided into two general classes. In one class the lighting is solely for the best possible display of the goods shown, and in the other class it is more of a spectacular order in which the attempt is to attract attention to the window as a piece of spectacular lighting rather than to the goods shown. For the display of goods pure and simple, practice has generally settled down to the use of concealed lamps located at the top or transom bar of the window, with windows which have a depth from 60 to 100 per cent of the height. This gives room for proper arrangement of goods and incidentally makes possible better lighting than when the window is very shallow and the light must be thrown onto the goods very obliquely from above.

At the Chicago meeting much emphasis was given—and, it seems to me, properly so—to the question of show-window backgrounds and the importance of having backgrounds which offer some contrast to the goods on display if the most striking effects are to be produced. The bad effects of making windows too shallow and overcrowding them were also pointed out, as it is practically impossible to light goods properly under such conditions. In show-window lighting on account of the restricted space which is to be lighted it is easily possible to employ arrangements which are very extravagant or wasteful. The use of reflecting appliances which do not confine the flux of light to the window where it is needed, or a lack of reflecting appliances altogether, is responsible for such waste. It is sometimes hard to make a merchant believe, when he is lighting his windows with a given satisfactory effect, that the same effect might be produced with half the expenditure of electrical energy, but this is in many cases true. Successful show-window lighting is a combination of the window trimmer's art with the illuminating engineer's science.

R. J. Davidson.

Chicago, Ill.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Single-Phase Repulsion Motors.—T. F. WALL.—In a previous paper the author developed the theory of the single-phase repulsion motor by an analytical method, on the basis of the actual flux distribution in the air-gap. If the flux distribution in the air-gap were sinusoidal, the problem could be dealt with by means of vector diagrams. But since this is not the case the vector diagram can give only approximate results. In the present paper the vector diagram for the single-phase repulsion motor is developed, and the results obtained in this way are compared with those obtained by the author in the previous analytical paper. From experimental data the relative accuracy of the two methods is found, and it is shown that for this type of motor the accuracy of the analytical method is much greater than that of the vector method. The vector treatment can, therefore, for this type of motor be taken only as a guide to the general behavior of the machine; but in all cases in which practical accuracy is required the analytical method should be used.—London *Electrician*, April 12, 1912.

Alternator for 2000 Cycles per Second.—W. DUDDELL.—An abstract of a London physical society paper. The author described and exhibited a small 2000-cycle alternator which he had designed and had constructed for testing purposes, mainly in connection with telephonic measurements. The alternator is of the salient-pole, revolving-field type running at 8000 r.p.m. The stator is smooth and wound like a Gramme ring, the object being to obtain as nearly as possible a sine wave. The output of the alternator amounted to as much as 0.5 kw at the higher frequencies. While the emf curves are nearly sinusoidal a third harmonic is present. —London *Electrician*, April 12, 1912.

Unipolar Dynamo.—F. CHARLES.—An illustrated account of the construction of the unipolar dynamo of Barbour which was exhibited at the Olympia Electric Exhibition in London and has already been described in our *Digest*. The author points out the suitability of driving this machine with a steam turbine and its suitability in electrometallurgical works.—*La Houille Blanche*, February, 1912.

Transformers.—F. C. GREEN.—The conclusion of a series of papers on alternating-current apparatus troubles. The author considers transformer operation under two main headings, namely, troubles which occur on first exciting and those which develop during service. Under the first heading a number of diagrams are shown illustrating the conditions which have to be met in the satisfactory parallel operation of transformers, single-phase and three-phase. The necessary theory is introduced to show how these methods may be generally applied to typical every-day problems. The second section considers mechanical trouble which may interfere with the proper ventilation of water-cooled, air-blast and oil-cooled transformers, and concludes with a consideration of the precautions which must be observed in systems where three-phase Y-connected generators are used for four-wire distribution.—*Gen. Elec. Review*, April, 1912.

Lamps and Lighting.

Illumination.—J. D. MACKENZIE.—An illustrated paper read before the Scotch local section of the (British) Institution of Electrical Engineers. After a few remarks as to the efficiency of light sources, the author discusses the calculation of the illumination in given cases. He then describes some interesting fittings for suspension over the road which have been installed at Barrow-in-Furness. The system is especially applicable for illuminating tramway roads where span-wire construction is in use. Between every two opposite poles not only the span wire carrying the trolley wire is stretched, but above it another span wire is stretched which carries two lighting fittings, two 60-watt metallic-filament lamps being used on each span. Finally a few notes are given of the measurement of illumination.—London *Electrician*, April 12, 1912.

Metallic-Filament Lamps.—A continuation of the long illustrated series on recent progress in incandescent-lamp manufacture. The description is chiefly based on German patent specifications. In the present instalment the methods of mounting the filament are described.—*Zeit. f. Beleucht.*, March 10, 1912.

Generation, Transmission and Distribution.

Electrically Driven Rolling Mill.—A note on a new electric rolling mill at the new steel works at Rehon, near Longwy, belonging to the Belgian firm La Providence, of Marchienne-au-Pont, near Charleroi. It consists of a blooming mill and a section rolling mill. The blooming mill is driven by a continuous-current motor giving 12,000 hp, fitted with an armature weighing 80 tons. The normal speed of the motor is 40 r.p.m., which can be increased to 120 r.p.m. The reversing motor is driven by means of a control gear which alters the excitation of the generator, and it is possible to obtain 20 reversals per minute. The ingots, which are rolled down to the minimum section of 4 in. by 4 in., weigh 4 tons and measure 28⅝ in. in width by 25⅝ in. in height, with a length of 5 ft. 7 in. In normal working the output is 50 tons an hour with an elongation varying from 9 to 24, but the production can be readily increased to 80 tons. The section rolling mill has been designed to deal with the manufacture of joists of large sizes and is driven by an electric motor developing 15,000 hp. The buffer set includes a flywheel weighing 65 tons.—London *Electrician*, April 12, 1912.

British Energy Supply Statistics.—A table of 119 electric energy supply stations in Great Britain, with the names of the engineers, the principal industries supplied, and details of the electric system employed, rates of charge, etc.—Supplement London *Electrician*, April 12, 1912.

Water-Powers in Spain.—A. BRILLOUIN.—A review of the water-powers in Spain and those which have been developed for the generation of electrical energy.—*La Houille Blanche*, February, 1912.

Blast-Furnace Gas Plants.—A. WITZ.—An article on the blast furnace as a gas producer and on the gas available for electric energy production at blast-furnace plants.—*La Lumière Elec.*, April 13, 1912.

Traction.

Single-Phase Traction.—An abstract of the official report on the results obtained during the first year on the single-phase road from Dessau to Bitterfeld. The figures given show that the results have really been better than had been expected in the original project. The wear and tear is small. This is especially noteworthy with respect to the commutators. The specifications required that in the passenger-train locomotives no repairs of the commutators should be necessary before 5000 locomotive kilometers (3000 miles), and for the freight-train locomotives before 2000 locomotive kilometers. As a matter of fact, two of the locomotives have already covered 30,000 km and 20,000 km respectively without any repairs of the commutators.—*Elek. Zeit.*, April 11, 1912.

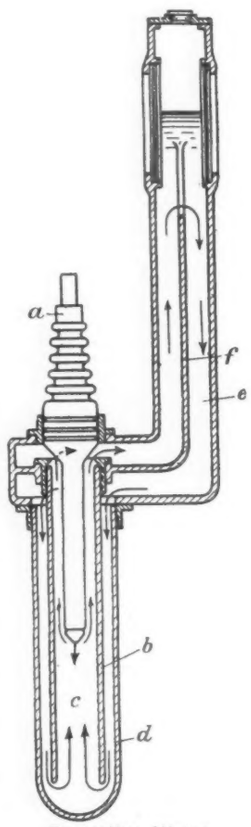
Gasoline-Electric Car.—An illustrated description of a 90-hp petrol-electric car for the Great Central Railway Company, in England. This is a new departure in

English railway practice, and it is thought that this system will probably be sufficient to carry the whole traffic on small branch lines. A car can very quickly be chartered as a "special," since there is no delay as with getting up steam, for the engine can always be started up at once and the car is then ready for service. The "layover" losses are entirely avoided, and the useful range of the vehicle may be anything desired, since fuel for very long journeys may be carried and the full power maintained continuously.—London *Electrician*, April 12, 1912.

Switzerland.—H. Stocker.—A long illustrated paper on the present status of electric traction in Switzerland.—*La Revue*, April, 1912.

Installations, Systems and Appliances.

German Electrical Industries.—A continuation of the long statistical review of the status of the German electrical industries in 1911. L. Finzi discusses the development of central stations and transmission plants in Germany. There exist now in Germany 2700 central stations, of which seven have a rating of more than 20,000 kw (the largest one being the Berlin station of 160,000 kw). There are twenty-three stations with ratings between 20,000 kw and 10,000 kw and twenty-three more with ratings between 10,000 and 5000 kw. From 1905 to 1911 the total rating of all stations has increased from 620,000 kw to 1,500,000 kw, and the total connections have increased from 650,000 kw to 2,500,000 kw. In mines and metallurgical plants, especially rolling mills, three-phase transmission is increasing in importance. In the textile industries the squirrel-cage, three-phase induction motor is very widely used; where speed regulation is required direct-current motors are used, but three-phase commutator motors are also being used now. In paper mills the direct-current motor is gradually being replaced by the three-phase commutator motor, which is also finding greater favor for driving tools. Vietze-Kastendieck reviews the development of transmission plants in agricultural districts, and K. Pichelmayer discusses the development of dynamo-electric machine design. While high-speed direct-current machines cannot be built for more than 1500 kw and 1500 r.p.m., low-speed rolling-mill direct-current motors have been built for ratings of 15,000 hp and may be built for even greater ratings. These as well as almost all direct-current machines are now provided with interpoles and often also with compensating windings. The use of the commutator in alternating-current machines is increasing rapidly and steadily. Single-phase commutator motors for heavy locomotives have been built for ratings of 2000 hp. As to the probable limit of rating of a single generator, the author thinks that the maximum may be assumed at present as 25,000 kw. H. Beckmann reviews the manufacture of storage batteries and Schwaiger the present status of the manufacture of switchboards.—*Elek. Zeit.*, April 11, 1912.



Protective Water Rheostat

Protective Water Resistors.—The usual non-inductive resistors used with lightning arresters and with appliances employed for protection against sudden dangerous rises of voltage have the disadvantage that when the current passes continually they may get heated and be destroyed. Such a continuous passage of current to earth occurs sometimes in cable networks when a ground connection has developed at a cable junctive box and is not at once noticed. To prevent a dangerous rise of temperature in the resistor, water circulation may be used as indicated in the cut. The electricity passes from *a* to the center *c* of the tube *b*, which is filled with water. The water is thereby heated and rises at once, while cold water sinks downward from the reservoir *e*. The circulation of the water is indicated by arrows. A window is provided to show whether there is any water in the resistor. (Nothing is said concerning electrolysis, although it is stated that a valve is provided in order to carry away any vapors which may form.) For filling the resistor pure water with an addition of a nickel salt is used. The resistors are able to carry 3 amp to earth for an hour or more without any detrimental rise of temperature.—*Elek. Zeit.*, April 17, 1912.

Use of Exhaust Steam.—Max Arbeiter.—A paper read before the Electrical Society of Vienna, in which the author describes the use of exhaust steam from electric supply plants for heating purposes. It is shown that a great saving can be obtained in this way, and a description is given of an actual installation.—*Elek. u. Masch.* (Vienna), April 14, 1912.

Storage Batteries for Intermittent Operation.—E. Ketzler.—An illustrated article in which the author shows that electric elevators, cranes, etc., may be connected satisfactorily to a lighting network if small batteries are provided.—*Elek. Zeit.*, April 11, 1912.

Electrophysics and Magnetism.

Effect of Temperature Upon Radioactive Disintegration.—A. S. Russell.—A note on a paper recently read before the Royal Society in London. The author investigated the effect of temperature upon the rate of decay and the amount of beta and gamma ray activity, of radium emanation, of active deposit and of radium C. The results are entirely negative. All abnormalities of activity of beta rays obtained by previous authors, and by the author in this research, may be completely explained on two simple grounds. The first of these is a change of distribution of radium C caused by its partial volatilization inside the quartz tube at temperatures greater than 320 deg. The second is a change in the partition of radium C between the walls of the quartz envelope and the space inclosed. At room temperature the greater part of the radium C is usually on the walls. At room temperature, after the tube has been cooled suddenly from high temperatures, it is entirely on the walls. Above 650 deg. the radium C is distributed homogeneously throughout the volume of the tube. Each of these partitions gives a different beta ray ionization in an electroscope, because the average path of the rays through the walls of the quartz envelope depends upon the partition. Under the conditions of experiment, radium B and radium C, and very probably radium A, may be completely volatilized inside sealed quartz tubes at a temperature of 650 deg. Radium B commences to volatilize at room temperature.—London *Electrician*, April 12, 1912.

Electrochemistry and Batteries.

Tests of Dry Batteries.—S. W. Melson.—An account of an investigation carried out in the (British) Physical Laboratory on dry batteries, the relation between the incidence of the discharge and the relative output ratings of cells of different manufacture. Four different makes of cell were tested and some different tests were employed. Test 1 represents as nearly as possible the working conditions of a cell on a telephone circuit, two cells working on a circuit the resistance of which is about 100 ohms and the average discharge five minutes per hour. The minimum current with which a telephone microphone would work was found

to be 0.018 amp, and the discharge of the cells was, therefore, considered to be completed when the emf had fallen to 0.9 volt at the end of any period of discharge. Test 2 was a discharge for five minutes per hour through a resistance of 1 ohm. Test 3 was specified by the National Telephone Company, the cells in this case being discharged continuously for six hours per day through a resistance of 5 ohms, resting the other eighteen hours. Test 4 was the test formerly specified by the British Post Office. Each cell was discharged continuously at a constant current (in this case 20 milliamperes) until the emf observed immediately after the current was switched off had fallen to 1 volt. Test 5 was the test most favored by manufacturers, each cell being discharged continuously through a resistance of 10 ohms. In test 6 each cell was discharged through a resistance of 100 ohms, the discharge being considered to be complete when the emf had fallen to 0.9 volt per cell. Test 7 is one of the tests used by the British War Office, and consists in observing the voltage of the cell when it is discharged continuously through a resistance of 500 ohms. The results are given in diagrams showing that the tests give the same relative order of merit for the cells, although there is considerable variation in the figure of merit from test to test. The author's conclusions are as follows: In view of the great differences between the relative results of different makes of cells under the various conditions of discharge, and also as to the relation between the incidence of the discharge and the output rating, it seems obvious that, with the exception of No. 1, none of the methods of test investigated can be relied on to give even an approximation of the relative permissible output rating of dry cells or of the output which may be obtained under working conditions. What may be called a "rough idea" of the relative value might, perhaps, be obtained for telephonic purposes from the results of a continuous discharge through a resistance of 100 ohms, but for a really correct comparison the test should be approximate as nearly as possible to working conditions. An account of the discussion which followed is also given.—London *Electrician*, April 12, 1912.

Electrolysis in Liquid Sulphur Dioxide.—L. S. BAGSTER AND B. D. STEELE.—A note on a recent Faraday Society paper. The paper describes experiments undertaken with the object of ascertaining the mechanism of electrolysis of solutions in liquefied sulphur dioxide. During the electrolysis of potassium, sodium, tetramethylammonium or trimethylsulphonium iodides sulphur is deposited on the cathode, a sulphite being simultaneously formed. In the case of potassium iodide the potassium sulphite, which is insoluble in the solvent, is deposited on the cathode in quantity nearly corresponding to that demanded by Faraday's law. At the anode there occur changes which are analogous to those occurring in aqueous solution, bromine and iodine being liberated from solutions of bromides and iodides, while anodes of zinc and iron are attacked, the metals passing into solution as complex salts. Evidence is adduced to show that water and hydrogen bromide unite to form an oxonium compound which is electrolytic in character, and this evidence is strengthened by comparison with well-known oxonium compounds. A number of such compounds have been found to be formed in sulphur dioxide solution, the solutions so formed being good electrical conductors. It is shown that metals immersed in solutions of their salts in sulphur dioxide have definite electrode potentials, several of which have been measured in saturated solutions.—London *Electrician*, April 12, 1912.

Electroplating.—A note on a recent British patent (No. 22,141, of April 4, 1912) of P. Marino and Q. Marino, relating to the deposition of gold, silver, platinum, copper, zinc, nickel, tin and lead or alloys upon metallic surfaces. It is proposed to prepare the electrolyte in such a way that it acts also as a pickling solution and therefore gives a tough deposit. The method consists in dissolving in an aqueous solution of sodium or potassium glycero-borbenzoate a salt of the metal or alloy to be deposited.—London *Elec. Eng'ing*, April 11, 1912.

Units, Measurements and Instruments.

Resistivity of Pure Iron Between 0 Deg. and 1000 Deg. C.—A. R. MEYER.—An account of measurements made in the lamp factory of Siemens & Halske. Three kinds of "pure" iron were tested. The following figures refer to electrolytic iron, which contained neither carbon, copper, manganese nor silicon, but only 0.008 per cent sulphur and 0.007 per cent phosphorus. This iron as obtained by deposition had at 20 deg. C. an electric resistivity of 10.95 microhms per cm cube. After having been heated for sixty hours to a temperature between 900 deg. and 1000 deg. the resistivity was 9.35 at a temperature of 0 deg. C.

Deg. C.	Resistivity
0	9.35
50	11.92
100	15.49
200	22.76
300	31.93
400	43.20
600	71.05
700	92.90
900	117.80

The resistivities of the other two samples of pure iron at the different temperatures are of the same order of magnitude.—*Deutsche Phys. Ges.*, Vol. XIII, p. 680; *La Revue Elec.*, April 12, 1912.

Comparing Capacities at Various Frequencies.—A. CAMPBELL.—An abstract of a paper read before the Physical Society in London. To compare the capacities of two condensers under conditions similar to those in Maxwell's commutator method, they are charged and short-circuited periodically in two adjacent arms of a bridge by a double rotating commutator, the corresponding contacts being made simultaneously. If the other arms of the bridge are resistors of resistances R and S, and a battery and direct-current galvanometer (of long period) are used, then a balance is obtained when $K_2/K_1=R/S$. The method is highly sensitive. Methods (like the above) in which the applied voltage has a square-topped wave-form give results in agreement with those using sine wave-form when the period of charge (and equal discharge) with the square-topped wave is $2/\pi$ times the half period of the sine wave.—London *Electrician*, April 12, 1912.

Magnetic Tests of Sheet Steel.—K. SCHMIEDEL.—An account of an experimental investigation carried out at the Reichsanstalt on the sources of error in determining the coefficient of loss by means of the Epstein apparatus. Air-gaps of less than 0.3 mm do not cause appreciable errors. With few comparative measurements a ring sample is unsuitable as object for comparison. The determination of the coefficient of loss is influenced to a very small degree by the way in which the iron sheets (one-half of which are cut parallel and the other half perpendicular to the direction of rolling) are arranged in the different bundles. The dimensions of the secondary coil are of small account as long as they are within the usual limits. The dimensions of the primary coil may cause greater errors.—*Elek. Zeit.*, April 11, 1912.

Electric Resistors.—N. CAMPBELL.—A note on certain liquid resistors which may be used for the same purposes as the "Bronson" resistors of ionized air. These resistors are mixtures of commercial xylol and absolute alcohol which has been distilled from lime. A series of resistors of resistances ranging from 3×10^7 to 10^{12} ohms has been made from such mixtures. The liquid resistors appear to have every advantage over Bronson resistors, except in the matter of sensitiveness to change of temperature. The

interesting fact is to be noted that the resistance, like that of metals and unlike that of electrolytes, increases with the temperature.—*Philos. Mag.*, April, 1912.

Meter.—An official communication from the Reichsanstalt, admitting a single-phase induction meter of Landis and Gyr for calibration. The construction and wiring connections are described and illustrated, and an outline is given of the method of calibration.—*Elek. Zeit.*, April 11, 1912.

Power Factor and Conductivity of Dielectrics at High Frequencies.—J. A. Fleming and J. B. Dyke.—The conclusion of their paper read before the (British) Institution of Electrical Engineers on the power factor and conductivity of dielectrics when tested with alternating electric currents of telephonic frequency at various temperatures. The conclusions are summed up as follows: All the dielectrics so far tested prove to possess a true dielectric conductivity for alternating currents considerably greater than for steady unidirectional currents. This increased conductivity implies greater rate of energy dissipation for the same terminal voltage. The alternating-current conductivity increases with the temperature, except in the case of vulcanized india-rubber rather below 20 deg. C. and gutta-percha rather above 15 deg. C., in both of which cases it decreases with rise of temperature. In the case of mica and very dry paper it is not affected to any sensible extent by rise of temperature over a range between 0 deg. C. and 60 deg. C. The alternating-current conductivity is in most cases a linear function of the frequency, and may be expressed in the form $a + bn$, where a and b are coefficients which are functions of the temperature and n is the frequency. The alternating-current conductivity, especially that part of it denoted by a, is greatly increased by the presence of moisture in the dielectric. This part is probably identical with the true direct-current conductivity. The part of the conductivity denoted by the coefficient a is possibly electrolytic in nature, while the part proportional to the frequency is a consequence of an energy loss which is possibly analogous to the hysteresis loss in iron. The dielectric constant for alternating electric force is in most dielectrics rather smaller than that for steady or unidirectional electric force. In no case is it larger. In the case of pure india-rubber and vulcanized india-rubber the temperature coefficient of the dielectric constant may perhaps be negative within the range of telephonic frequencies and 0 deg. C. to 50 deg. C., but this result is not quite certain. The ratio $S/c\omega$, nearly identical with the power-factor, is for some dielectrics, such as mica and dry paper, a constant independent of frequency and temperature. The meaning of $S/c\omega$ is that the condenser is represented as consisting of a perfect capacity c shunted by conductance S, while ω is 2π times the frequency. For most dielectrics it increases with rise of temperature but decreases with a rise of frequency. The power-factor variation with temperature of vulcanized india-rubber and gutta-percha is quite abnormal. Those dielectrics, such as celluloid and gutta-percha, which have large alternating-current conductivity, although free as far as possible from moisture, also exhibit in a marked manner the phenomena of dielectric absorption and residual charge. For certain dielectrics there is a temperature at which the power-factor and alternating conductivity have maximum values.—London *Electrician*, April 12, 1912.

Telephone Factory.—An illustrated description of the Sterling Telephone Works, Dagenham, Essex, England.—London *Elec. Review*, April 12, 1912.

Miscellaneous.

Reinforced Concrete Beams.—R. L. Humphrey and L. H. Losse.—An illustrated account, containing 200 pages, of measurements of the strength of reinforced concrete beams. The result of tests of 333 beams are given.—*Technolog. Papers, Bureau of Standards, No. 2.*

Book Reviews

Electric Discharges, Waves and Impulses. By Charles Proteus Steinmetz, Ph.D. New York: McGraw-Hill Book Company. 149 pages, 64 illus. Price, $2.50.

A review of "Transient Electrical Phenomena and Oscillations," by Dr. Steinmetz, appeared on page 1321 of our issue dated May 27, 1909. The present book covers much of the same ground covered by the earlier book, but the method of treatment is essentially different. In the former work little attempt was made to substitute physical reasoning for mathematical representation, while in his latest book the author has discussed in simplified terms the physical phenomena involved. However, the treatment can hardly be characterized as non-mathematical, as the discussions are really explanations of the algebraic, trigonometric, logarithmic and calculus equations. Among the subjects treated in this manner are the nature and origin of transients, the electric field, single-energy transients in continuous-current and alternating-current circuits, single-energy transients of iron-clad circuits, double-energy transients, line oscillations, traveling waves, oscillations of the compound circuit and inductance and capacity of round parallel conductors. A valuable feature of the book resides in the many oscillograms of electric discharges, waves and impulses obtained upon electric circuits of various kinds. The agreement of the theories propounded with the facts recorded by the oscillograph increases the reader's interest in the subjects discussed and his faith in the accuracy of the theory. The treatise is one that can be read with profit by anyone interested in transient phenomena who is familiar with the usual branches of mathematics and of fundamental electrophysical relations.

Ship Wiring and Fitting. By T. M. Johnson. New York: D. Van Nostrand Company. 77 pages, 47 illus. Price, 75 cents.

A handy little pocket-book for the use of the marine wireman, electrician and dynamo tender. The essential features of direct-current wiring and installation on board ship are described and clearly illustrated, with particular reference to British practice and to passenger ships. The treatment is of a very sound and practical character. For instance, cockroach-proof ship's bell indicators are specially and very properly detailed in reference to vessels which navigate in hot climates. The book will be very useful to practical men who have either to install or to maintain wiring on board large ships. In a future edition a chapter might advantageously be added on the wiring of wireless outfits on board ship.

Edison. Tobb Forrasmunka Alapjan. By Balla Ignac. With introduction by E. de Fodor. Budapest: Singer & Wolfner. 223 pages, illustrated.

During the visit of Mr. Edison last fall to Budapest, Hungary, Mr. Etienne de Fodor, head of the Budapest General Electric Company, who was associated in this country with the early work of Edison and was a pioneer in introducing the Edison system in Europe, suggested to a well-known Hungarian author the writing of a popular book dealing with Edison and his inventions. The result is a handsome volume, just published, to which Mr. de Fodor supplies an introduction of twelve pages. On the back of the title page is a reproduction in the handwriting of Edison of the following tribute to the Hungarian capital: "Budapest seems to me the most beautiful and progressive city that I have thus far seen in Europe. Thomas A. Edison." Among the full-page illustrations are several reproductions of photographs taken at Menlo Park in the days when Edison was bringing out some of his most remarkable inventions.

New Apparatus and Appliances

DES MOINES ELECTRIC SHOW.

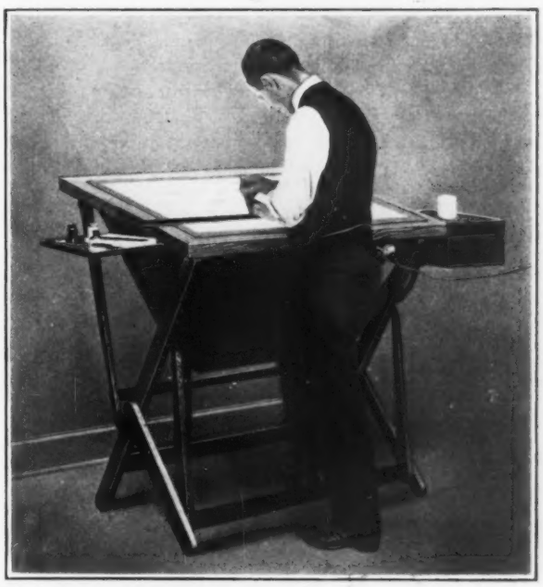
An electric show that elicited the praise of all who saw it was given at the Coliseum in Des Moines on April 23 to 27, inclusive, in conjunction with the annual conventions of the Iowa State Electrical Association and the Iowa Street & Interurban Railway Association. The public of Des Moines was admitted on payment of 25 cents admission fee, and the number of paid admissions was gratifyingly large. The spectacle presented by the brilliant illumination, the decorations of the hall and the attractive booths was entirely pleasing, and the show was the most successful of the kind ever held in the State of Iowa. The ceiling of the Coliseum was arranged to represent a night sky effect, with twinkling stars. One unusual feature was the general illumination of the interior by lamps supported on fifty-eight "electrolier" posts such as are used for curb lighting. These were actual iron posts painted white and were not merely temporary standards arranged for the exhibition; in fact, nearly all of them will be sent out to fill orders for actual service installations by the manufacturers, the McDonnell Boiler & Iron Works, of Des Moines. Each of the posts supported five tungsten lamps inclosed in opalescent globes. The makers of these "electroliers" had a booth in the show, and eight other lamp standards were shown here.

A number of popular features were arranged during the show, one of the most effective being a spectacular electrical display or electrical "storm." By the use of high-tension discharges and thunder and rain machines, a very effective representation of a thunderstorm was given twice a day. During this "storm" the lights were turned out and the orchestra played appropriate music. With the dying out of the storm the stars came out again, and finally, with a triumphant burst of harmony from the orchestra, the full lighting was turned on. The effect was very good. Mr. C. A. Willoughby, of the Des Moines Electric Company, was the manager of the show, acting for Mr. W. H. Thompson, manager of the company, who is chairman of the committee of arrangements. Mr. Thompson is just recovering from the effects of a serious automobile accident and therefore a more than usual amount of detail fell on the shoulders of Mr. Willoughby. The central feature of the exhibit was the popular central-station display of the Des Moines Electric Company.

The following is a list of the names of the exhibitors: Allis-Chalmers Company, Milwaukee; Julius Andrae & Sons, Milwaukee; Atlas Railway & Supply Company, Chicago; Automatic Electric Washer Company, Newton, Ia.; Bell Electric Motor Company, New York; Benjamin Electric Manufacturing Company, Chicago; Bernhard-Turner Auto Company, Des Moines; Brilliant Electric Works, Des Moines; Bryan-Marsh Company, Chicago; Century Electric Company, St. Louis; Dearborn Drug & Chemical Company, Chicago; Des Moines Electric Company, Des Moines; Des Moines Electric Contracting Company, Des Moines; Diamond Electric Company, Binghamton, N. Y.; Downing Electric Company, Des Moines; Duncan Electric Manufacturing Company, Lafayette, Ind.; Electric Appliance Company, Chicago; Electric Manufacturing Company, New Orleans, La.; Fairbanks-Morse Company, Chicago; Fort Wayne Electric Works, Fort Wayne, Ind.; Franks Manufacturing Company, Rock Island, Ill.; W. R. Garton Company, Chicago, Ill.; General Electric Company; Globe Manufacturing Company, Perry, Ia.; Globe Machinery & Supply Company, Des Moines; Highland Park College, Des Moines; Hurley Machine Company, Chicago; Illinois Electric Company, Chicago; Iowa Electrical & Machinery Company, Waterloo, Ia.; H. W. Johns-Manville Company, New York; Kinetic Engineering Company, Philadelphia; Lennan Electric Company, Des Moines; Loetscher-Ryan Company, Dubuque, Ia.; McDonnell Boiler & Iron Works, Des Moines; Minerallac Company, Chicago; Monarch Electric Company, Des Moines; Monarch Electric & Wire Company, Chicago; "1900" Washer Company, Binghamton, N. Y.; Northwestern Electric Equipment Company, St. Paul, Minn.; Richmond Sales Company, Chicago; Santos Cleaner Company, Philadelphia; Shannon-Mott Company, Des Moines; Simplex Company, Cambridge, Mass.; Superior Fixture Company, Des Moines; St. Louis Car Company, St. Louis; Tel.-Electric Company, Chicago; J. B. Terry & Company, Cedar Rapids; Thordarson Company, Chicago; Tri-City Electric Supply Company, Davenport, Ia.; Wagner Electric Manufacturing Company, Chicago; Western Electric Company, New York; Wheeler, Fisher & Company, Chicago; Westinghouse Electric & Manufacturing Company.

A SHADOWLESS DRAFTING TABLE.

The drafting table illustrated herewith is arranged to be electrically lighted from beneath, the top of it consisting of a sheet of ground plate glass in a wooden frame of the size of an ordinary drawing table. Beneath the surface of the table is a pyramidal-shaped box containing three 25-watt upright tungsten lamps for ordinary work, although larger lamps may be used if required. The inside of the box is painted a dull white, with a specially prepared paint, and the light from the vertical lamps reflecting on the inclined sides produces a diffused light through the ground-glass surface on which the drawing or tracing is done. Taking the light through the drawing from beneath, rather than from above, avoids shadows from the set square, straight-edge or other drawing instruments. The shape of the interior of the box and the reflecting surface are such as to diffuse the light so that the sources are not seen through the ground glass. The lamps are mounted in porcelain sockets placed on a hinged base which may be lowered for cleaning or renewing the lamps.



Shadowless Drafting Table.

As the box is open at the lower part and is provided with a vent in the upper part, a circulation of air is provided to keep the drawing table cool. However, the opening at the top is provided with a shutter which may be closed if it is desired to utilize a certain amount of heat when the draftsman wishes to work rapidly in tracing plans with ink. In that case there is sufficient warmth in the glass to cause the ink to dry almost instantly; furthermore, the warmth may be utilized to keep the tracing cloth tight over the drawing in damp weather. The great advantage of the table, in addition to its "shadowless" characteristic, is the fact that it may be used in the darkest corner of an office if required. This interesting device is the invention of Mr. C. B. Ulrich and is manufactured by the Wausau Fixture & Furniture Company, of Wausau, Wis.

A NEW NICKEL-IRON STORAGE BATTERY.

The accompanying engravings illustrate a type of nickel-iron alkaline storage battery which has been placed on the market by Paul Gouin, of Paris, France. In the Gouin cell the electrolyte is a potash solution varying in strength from

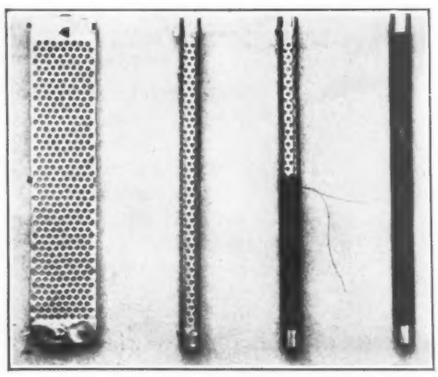
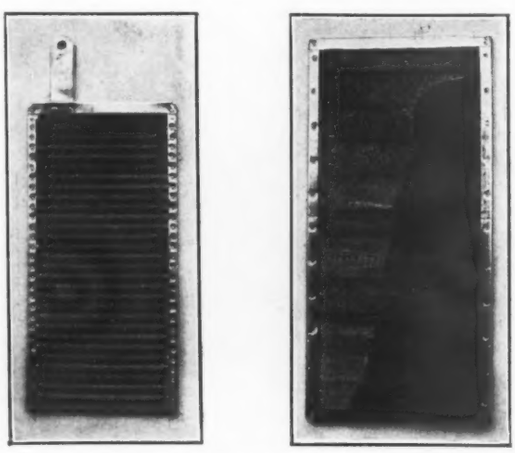


Fig. 1—Steps in Making Positive Element.

20 per cent in stationary batteries to 22 per cent in traction cells. The positive elements are formed by perforated tubes of pure nickel filled with specially prepared hydroxides of nickel mixed with powdered graphite. The tubes are strengthened by a spiral winding of twisted nickel wires,



Figs. 2 and 3—Positive and Negative Plates Respectively.

oxidized, and all parts of the tube and active material are in continuous and perfect electrical contact. Once filled, the ends of the tube are closed with ebonite stoppers. Each positive plate consists of thirty of these tubes held horizontally between the two uprights of a nickel U-shaped frame, the tubes being attached to the frame by rivets of pure nickel. The complete frame, including a nickel cross-piece at the top and a nickel lug or blade for the connectors, has about three-fourths of its weight in active material. The negative electrode is formed of iron wire plaited into a kind of thin flat ribbon and suspended from a horizontal bar at the upper part of the cell. The protoxide of iron is

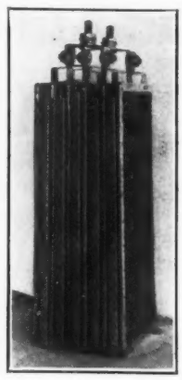


Fig. 3—Plates Assembled.

formed directly on the metallic plaiting, making the character of the negative electrode autogenous—that is, requiring no additional active material. The electrical connectors are of pure nickel.

The construction is simple, requiring few special tools. It is stated that the negative plates are very inexpensive and that the entire cost is much less than has hitherto been thought possible for a practical cell of the alkaline type. Plates for batteries of different ratings vary but little, so that uniform materials are used in all kinds and the manufacturing process will therefore be found to be correspondingly easy.

In a paper on the Gouin cell read before the Electrical Congress at Turin last fall, it is stated that both positive and negative plates showed no deterioration after 400 to 500 discharges with the traction type and twice that number with the stationary type. Short-circuits or very rapid discharges did not deteriorate the cells. The normal rate of discharge for traction cells was from three to five hours. Oxidation of the contacts, deformation of plates, loss of active material, escape of gases during discharge and other battery troubles were entirely absent. According to this paper, the Gouin cell compares favorably in cost of manufacture with the lead cell, has a practically insignificant maintenance or upkeep expense and the highest output per pound of total weight yet obtained.

FLEXIBLE INTERMEDIATE POLES FOR TRANSMISSION LINES.

In order to minimize the cost of a permanent transmission-line system of supports it is permissible to substitute simple steel poles for many of the more complicated steel towers now used for the purpose. With strong stiff poles or towers at, say, every seventh point of support, cheap flexible poles can be placed at the intermediate locations with thoroughly satisfactory results. The Carbo Steel Post Company, Chicago Heights, Ill., has placed on the market a form of right-angle steel upright suitable for the intermediate poles of a transmission system. The pole is provided with a sustaining base placed so far below the ground level that the upright remains flexible down to and part way into the ground. Holes 1 in. in diameter bored at frequent intervals afford means for attaching cross-arms and allow the poles to be climbed without any difficulty by linemen who are provided with climbers of a suitable description.

EXHIBITS AT SOUTHWESTERN CONVENTION.

A large hall adjoining the convention room of the Southwestern Electrical and Gas Association, whose meetings were held at the St. Anthony Hotel, San Antonio, Tex., April 25 to 27, was occupied with exhibits by manufacturers and dealers, as follows: Atlas Railway Supply Company, Chicago, rail joints and supplies; Buckeye Electric Works of General Electric Company, Dallas, incandescent lamps; Century Electric Company, St. Louis, motors; Service Supplies Company, Chicago, electric line material; General Electric Company of Texas, Dallas, electric heating appliances, ozonizer; Goldschmit Thermit Company, New York, welding equipment; Holophane Company, Newark, Ohio, reflectors; Ohio Brass Company, Mansfield, Ohio, line material; Tool-Steel Gear & Pinion Company, Cincinnati, Ohio, gears; Telelectric Company, Houston, Tex., motors, wire, supplies; Wagner Electric Manufacturing Company, St. Louis, Mo., motors, transformers; Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., reception room.

CURRENT TRANSFORMER FOR HIGH-VOLTAGE SERVICE.

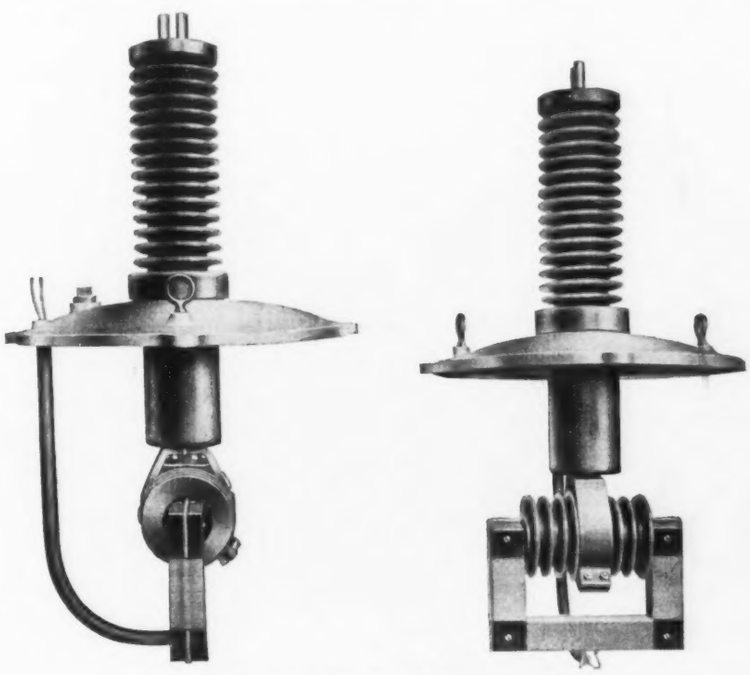
The current transformer illustrated herewith has been designed to give a reliable twenty-four hours per day means of registering the power flowing in high-tension lines. As will be seen, the transformer comprises an outlet bushing with copper bar terminals, or primary leads, molded in. This bushing is mounted on the cover and in turn supports the transformer carcass. The latter consists of a porcelain bushing, one primary coil, two secondary coils, one cast-copper shackle (in two parts) and the laminated iron core.

The bushing is recessed at both ends to admit the secondary coils, and the outside waist of the bushing is contracted to hold the primary coil. The two parts of the shackle are insulated from one another by suitable fiber blocks and bushings. The insulating coupling is held together with two bolts passing through metal flanges, fiber block and bushing, thus making a strong rigid shackle, which is bolted to the primary leads. The two ends of the primary coil are electrically connected to the shackle in such a manner that the latter is always one turn of the primary winding, namely, part of the first and part of the last turn.

It will be seen that with the laminated iron core passing through the bushing and suspended therefrom there is the novel condition of a transformer hanging by its primary leads. By this simple means of suspension the task of insulation is so lightened as to be easily accomplished. The secondary leads are brought out through a rigid metal conduit which is attached to the cover, which results when removing the cover in the removal of the whole transformer. This is so light that, with the exception of the 100-kw transformer, one man can easily handle it.

The tank is a one-piece boiler-plate, acetylene-welded tank, and the assembled transformer filled with clean dry mineral seal oil is practically indestructible when subjected to the service for which it is intended.

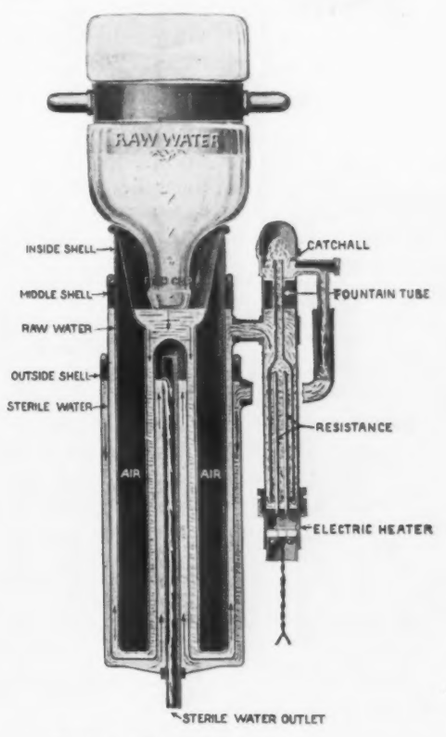
The transformer is made for three principal voltages, 40,000, 60,000 and 110,000 volts. It is built for any range of current from 5 amp to 500 amp, the secondary coils being wound for 5 amp on all sizes. The transformer is sold exclusively by the H. W. Johns-Manville Company, New York, and is manufactured in indoor and outdoor types in all voltages up to 150,000 volts.



Current Transformer for High-Voltage Service.

SMALL ELECTRIC WATER STERILIZER.

A water sterilizer operating upon the heat-treatment principle is illustrated herewith. Raw water from the inverted bottle enters the central chamber surrounding the sterile water outlet and passes upward along the outer chamber, which is surrounded by a sterile water chamber and flows into a chamber where it is boiled, after which it passes in thermal conductivity contact with the entering cold raw water to which it imparts some heat and thus becomes cooled. The heating element is of the electrical-resistance type, giving a highly concentrated heating effect which insures the movement upward of the sterilized water through the fountain tube into the catch-all, from which it



Electric Water Sterilizer.

flows by gravity into the outer sterile water chamber. The thermal-contact arrangements are such that by the time the raw water enters the heaters it is preheated to a high temperature, while the temperature of the sterile water is reduced to almost that of the cold raw water before it finally reaches the outlet. Thus an effective use is made of the heat absorbed and the consumption of electricity is small. It is said that the United States government has used this type of sterilizer for the past twelve years. Only very recently, however, was the apparatus reduced to a form small enough for domestic household and small office use. This sterilizer is manufactured by the Forbes Company, 1208 Callowhill Street, Philadelphia.

ELECTRICALLY EQUIPPED BED.

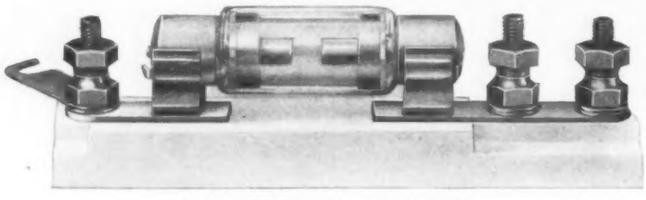
The bed illustrated herewith is provided not only with an electrical heating pad and a ventilating fan, but also with four lamps, one on each post. On the right-hand bedpost

Electrically Equipped Bed.

are placed switches for controlling these devices. Outlets are also arranged for other devices useful in a bedroom, such as an electric toaster, a water heater, etc. This bed was built by the Fanner Manufacturing Company, Cleveland, Ohio.

VACUUM-TYPE LIGHTNING ARRESTER.

Herewith is illustrated a simple device resembling an inclosed fuse installed in the regular spring fuse mountings which is employed as a lightning arrester for protecting fire-alarm, cable, telegraph, telephone and similar circuits. The lightning discharge takes place within a vacuum tube which surrounds an inner shield of mica mounted on porce-



Vacuum-Type Lightning Arrester.

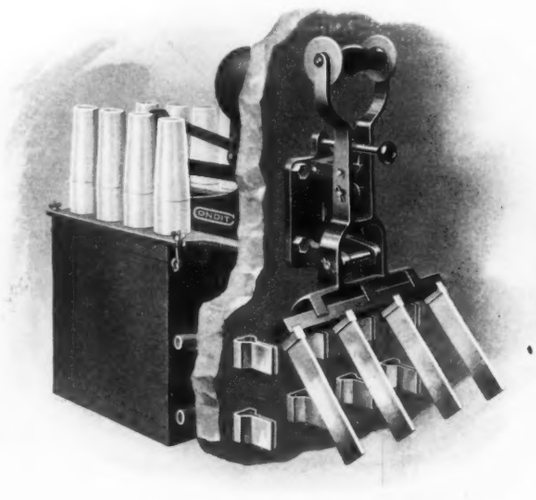
lain spool heads. The mica shield receives the heat and shock of the discharge, thereby protecting the outer shell of glass. It is claimed that the vacuum-type arrester affords a good conducting path for extraneous charges while maintaining insulation for either unidirectional or alternating emf. This device is manufactured by the L. S. Bach Supply Company, 143 Liberty Street, New York.

SWITCH FOR BREAKDOWN SERVICE.

The custom of providing what is known as breakdown service for private plants located in the vicinity of transmission systems has become practically universal. The practice has also spread in many cases to factories and to important station, subway or other lighting where it is necessary to keep certain motors running or certain lamps burning no matter what happens to the rest of the plant.

The usual practice in such cases has been to provide a double-throw switch, the clips of the switch being connected to the lamps or motors it is desired to control, and one side of the switch feeding from one source of power and the other side from the other source of power. Heretofore these switches have not been automatic.

As a result of the demand which has grown for a reliable, rugged, simple, automatic device for effecting this throw-over to the auxiliary service whenever the main service failed, the Condit Electrical Manufacturing Company has developed the switch shown in the accompanying illustration and intended particularly for alternating-current service. In construction it consists of a standard Condit oil switch or circuit-breaker mounted on the back of the switchboard panel, but the operating handle is provided with the blades of a knife switch and is so arranged that the opening of the oil switch causes the closing of the knife switch and vice versa. The oil switch is intended to control the main circuit and the knife switch the auxiliary circuit. A no-voltage release is provided in connection with the oil switch, and should the voltage fail for any reason on the main circuit, powerful springs will at once throw the switch from the main circuit into the auxiliary circuit. This action is so quick that it is hardly noticed on the lights, and induction motors do not drop out of step. The switch is simple, is free from complicated interlocking mechanism, and it is absolutely impossible to close both circuits at once. It has been found particularly useful in such situations as subway lighting and in theater lighting. The auxiliary circuit can be fed from an outside source from storage batteries or from separate generators. The switch furnishes the central-station manager a field for



Switch for Breakdown Service.

his energy which could not be obtained by the use of the double-throw, non-automatic breakdown service switch.

This switch is made either plain no-voltage trip or overload no-voltage trip, and it provides not only an automatic breakdown service but also a standard circuit-breaker protection for the main circuit. There is no automatic protection on the auxiliary circuit of this device.

Industrial and Commercial News

ACCORDING to the report of the United States Steel Corporation for the quarter ended March 31, made public this week, a deficit of $6,292,134 remained after allowing for preferred and common dividends. This quarterly deficit is the first reported since March, 1904. In view of the higher prices and brisk demand for steel at present the outlook for a better showing for the rest of the year is decidedly promising. Business continues to expand slowly, and in spite of irregularity in various parts of the country there is a strong feeling that progress is being made. The record of new incorporations during the month of April, showing substantial increases over the total of the previous month, noted on the following page, indicates a high degree of confidence in the future. As is usual at this time of the year, unfavorable crop reports are being circulated, but their effect in curtailing operations is not especially noticeable. The money markets are quiet. Rates in New York, May 1, were: Call, 2½@2¾ per cent; ninety days, 3@3¼ per cent.

THE COPPER MARKET.

Demand for copper improved slightly this week, but the volume of business at best was of small dimensions. Most of the domestic consumers purchased only to cover current needs, and the rate of sales did not approach that in March, when prices were advanced. Quotations this week ranged from 16 cents to 16⅛ cents for electrolytic, delivered thirty days. The higher price was asked by several of the larger agencies, but concessions were easily obtained from smaller interests. The March report of the Copper Producers' Association, which is due to be published on May 8, is expected to show an increase in surplus stocks in the United States, a condition which will be somewhat gratifying to producers, as further advance in prices is not desirable at present in view of the quietness of the market. Smelter production of primary copper in the United States last year was the largest on record, according to a statement issued last week by the United States Geological Survey. The refined output, as shown in this statement, including the production of plants handling only secondary material, was 1,648,082,753 lb., which, it is stated, is 186,300,000 lb. in excess of the output of refined copper reported by the Copper Producers' Association. Exports in the month of April were 22,341 tons. The daily call on the New York Metal Exchange quoted copper as per the accompanying table.

Standard.	Bid.	Asked.	Settling Price.
Spot	15.50	15.75	.....
May	15.50	15.75	15.62½
June	15.50	15.70	15.60
July	15.55	15.60	15.57½
August	15.55	15.60	15.57½

The London market, May 1, was as follows:

	Noon.	Closing.
	£ s d	£ s d
Standard copper, spot	70 7 6	70 3 9
Standard copper, futures	71 3 9	71 0 0

Extreme fluctuations in 1912:

	Highest.	Lowest.
Standard	15.62½c	13.65c
London, spot	£71 0 0	£60 16 3
London, futures	72 2 6	61 10 0
London, best selected	75 10 0	65 5 0

INDUSTRIAL AND COMMERCIAL NOTES.

Philadelphia Company Planning Improvements.—Stockholders of the Philadelphia Company, which controls the Pittsburgh Railways Company, at a meeting on April 29 authorized the issuance of $25,000,000 additional capital stock and $10,000,000 additional debentures, convertible at the option of the holder into cumulative preferred shares of the company. The capital stock of the company is $48,400,000 and with the new capitalization will be $73,400,000. It is not intended to issue the $25,000,000 increased capitalization at once, but as conditions warrant. The new stock is to be preferred as to dividends and will be entitled to 6 per cent annually out of the net earnings of the company before the dividend is paid on the common stock, of which there is $42,400,000. Six millions of the new capital stock is to be offered to the holders of the existing preferred shares, on which the dividend is 5 per cent and is non-cumulative. Of the other $19,000,000 authorized $10,000,000 is to be set aside for the conversion of the $10,000,000 debentures authorized at the meeting. The remaining $9,000,000 is to be held in the treasury and issued as the directors see the necessity. The issuance of the $10,000,000 debentures will provide working capital to be used on extensions and betterment and improvement of all properties. The major portion, it is stated, will be used to the betterment of the car service, almost $6,000,000 being intended for this purpose. Expenditure of about $700,000 upon power-house and substation work is among the plans which the officials intend to carry out as soon as possible. That adequate power may be had, it is proposed that work be begun soon on the Brunot's Island and Twentieth Street plants, the capacity of each to be increased about 25 per cent. A new generator is to be installed. About 70 miles of tracks are to be reconstructed and extensions made to the carhouses and shops to house the equipment and keep it in repair.

Plan to Reduce Number of Directors of Cincinnati Gas & Electric Company.—The following petition, which, it is expected, will be signed by many of the stockholders, has been drawn up for presentation to the nominating committee of the Cincinnati Gas & Electric Company, of Cincinnati: "The undersigned stockholders of the Cincinnati Gas & Electric Company recommend that at the annual meeting of the company, to be held May 6, the board of directors be reduced from fifteen to eleven members, and feel that their interests should be more directly represented on the board of directors than has been the case in the past." Accompanying this will be a supplementary slip containing the names of the men they favor for membership on the board, as follows: George D. Eustis, Charles F. Windisch, H. L. Brenneman and Edward H. Ernst. Those in charge of the petition state that they have no hostility toward the present board, but they desire a more direct representation of their stock and a closer community of interests.

Railway Storage Battery Car Company Organized.—A new company, known as the Railway Storage Battery Car Company, has been incorporated in Maine, with an authorized capital stock of $4,000,000 in shares of $100, to finance and sell the output of the Edison-Beach car-manufacturing plant. Of the authorized stock $1,000,000 is 7 per cent cumulative preferred. T. D. Rhodes, vice-president of the New York, Westchester & Boston Railway Company and receiver of the Detroit, Toledo & Ironton Railway, has severed his connection with these properties to become president of the new company. The manufacturers of the Edison-Beach cars have the exclusive right to the use of the Edison storage battery as applied to railway equipment.

Isthmian Canal Proposals.—Sealed proposals will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until 10.30 a. m. May 22, 1912, for furnishing seventy-two three-phase motor-service transformers, thirty-nine single-phase lighting transformers, thirty-six oil-switch banks, thirty-six switchboards and a quantity of miscellaneous material required in the installation of the foregoing. Circular No. 705 of the Isthmian Canal Commission, giving full details and specifications of the above, will be forwarded upon application to the commission.

Appointment of Ancillary Receivers for Allis-Chalmers Postponed.—Judge Landis, of the United States District Court, Chicago, deferred action in the appointment of ancillary receivers for the property of the Allis-Chalmers Company in Illinois, which was to have taken place last week, as noted in the previous issue, until May 2. Time for deposit of Allis-Chalmers bonds and stock in accordance with the reorganization plan expired on April 30, but it is expected that a reasonable extension will be granted.

New Offices for Public Utility Managers.—Among the many prominent concerns in New York's financial district which moved their offices to the new Bankers' Trust Company Building, 14 Wall Street, on May 1, are Hodenpyl, Hardy & Company, who are managers of the Union Railway, Gas & Electric Company, of Rockford, Ill.—which operates a number of gas, electric-light and traction companies in Indiana, Illinois and Wisconsin—and managers of the Commonwealth Power, Railway & Light Company, of Jackson, Mich. Kissel, Kinnicutt & Company, H. F. Bachman & Company, White, Weld & Company, Thompson, Towle & Company and William P. Bonbright & Company are among other financial houses that have moved to new quarters at 14 Wall Street.

April Incorporations.—Papers filed in the Eastern States in April for companies with an authorized capital of $1,000,000 and over authorized issues of $281,457,000, according to compilation by *The Journal of Commerce*, New York. This total represents an increase of $120,379,000 over March, and $222,767,000 as compared with April, 1910. Charters taken out during the month by other companies with an individual capital of $100,000 or over, but less than $1,000,000, brought the total for April up to $370,184,500, which compares with $252,363,000 in March last and with $146,864,000 in April a year ago.

Large Motor Order for Panama Canal.—According to the *Canal Record* the Isthmian Canal Commission has entered into contract with the General Electric Company for 246 motors to be operated on 220-volt, 25-cycle, three-phase circuits. Of this number of motors 116 are to be of 50 hp each for the rising-stem gate-valve machines at the canal locks and 130 of 7.5 hp each for the cylindrical-valve and auxiliary culvert-valve machines. The expenditure of the commission for these motors will be about $120,000.

To Build Power Plant at Oklahoma Coal Mines.—Plans are being drawn for a large power station which is to be erected for the Oklahoma Power & Electric Company about 10 miles from Durant, Okla., where the electric company has valuable coal holdings. The cost of the plant will be about $1,500,000. Energy will be transmitted to Fort Worth, Dallas, Oklahoma City, Little Rock and the principal cities in Oklahoma, Texas and Arkansas.

New Westinghouse Director.—Paul M. Warburg, of Kuhn, Loeb & Company, has been elected a director of the Westinghouse Electric & Manufacturing Company, succeeding Charles A. Moore, resigned.

Aluminum Notes and Prices.—The aluminum market has been steady this week. Prices per pound in ton lots on May 1 were: No. 1 pure ingot, 20@21 cents; rods and wire, base price, 31 cents, and sheets, 33 cents.

Financial

Public Service Company of Northern Illinois to Issue Additional Stock.—By a resolution of the directors adopted April 23 the Public Service Company of Northern Illinois has decided to issue additional 6 per cent preferred stock to the amount of 25 per cent of the preferred and common stock now outstanding. The new preferred stock, which will amount to about $3,300,000, will be offered at par to stockholders of record of May 4, each of the stockholders at that time being entitled to subscribe for the new stock to the extent of 25 per cent of his holdings at that time of both common and preferred stock. Rights of stockholders to subscribe for the new stock on these terms will expire on May 18. The proceeds will be used to acquire new properties and for general expenses. The preferred stock of the company, with the rights for the new stock, was quoted at about 104 on April 29. Chicago brokers are also offering for sale first and refunding 5 per cent gold bonds of the same company to the amount of $3,300,000, dated Oct. 1, 1911, and due Oct. 1, 1956. The Public Service Company of Northern Illinois, which is an Insull property, now operates in thirteen counties in the northeastern part of the State of Illinois, practically surrounding Chicago, and serving a territory with a population of nearly 500,000. The bonds are secured by a mortgage covering as a direct lien all fixed property owned or hereafter acquired by the company. They are offered at 99½. Details of formation of the company, the properties which it took over, etc., can be found in the *Electrical World* for Nov. 18, 1911,, page 1265.

McCrum-Howell Protective Committee.—J. M. Pratt, vice-president of the Standard Trust Company, New York; H. T. Ambrose, president of the American Book Company, New York; A. L. Shapleigh, St. Louis; E. P. Russell, of Russell, Brewster & Co., Chicago, and W. C. Niblack, vice-president of the Chicago Title & Trust Company, compose a protective committee for holders of McCrum-Howell stock. The Chicago Title & Trust Company and the Standard Trust Company, New York, are depositaries. W. C. Cox, Standard Trust Company, New York, is secretary of the committee. The report of the receivers, E. R. Stettinius and W. H. Woodin, shows a balance of assets amounting to $86,000 on March 15. The receivers state that difficulties were experienced owing to unsatisfactory bookkeeping methods. The report says in part that analysis of accounts receivable showed a large number of worthless accounts and that a deduction of $1,182,240 for bad debts was made on this basis. Appraisal of plants, etc., showed a valuation of $1,181,008. All appeared to be free of encumbrances except a Philadelphia warehouse subject to $20,000 mortgage. Contingent liabilities amounted to $53,653, the greater part of which will not have to be paid, while disputed claims were $613,686. The balance sheet showed total assets, exclusive of patents, etc., of $2,662,958: cash, $25,920; accounts and bills receivable, $692,373; inventories, $668,578; plant and real estate, $1,146,528; investments, etc., $95,078. Liabilities—Miscellaneous creditors, $310,742; notes and bills payable, $2,250,633; miscellaneous, $15,653; total, $2,577,030, giving a balance excess of assets of $85,928.

Illinois Northern Utilities Company.—As foreshadowed in the *Electrical World* of April 20, page 869, the authorized capital stock of the newly organized Illinois Northern Utilities Company of Chicago was increased from $1,000 to $20,000,000 on April 23. The capitalization will be divided equally between preferred and common shares. The company is controlled by Samuel Insull and his associates, and it is formed to acquire public-utility properties in northwestern Illinois, between the territory of the Public Service Company of Northern Illinois (which operates in the northeastern part of the State and is also an Insull company) and the Mississippi River. It has not been determined just what properties are to be absorbed by the new company, as negotiations are pending, but the number will be considerable. It has been stated that the properties at Sterling and Rock Falls, Ill., where the Sterling Gas & Electric Company now operates, will be the center for the new corporation, and that various properties along the Rock River will be taken over later. Of the authorized stock $1,813,000 of the preferred and $4,635,000 common will be issued. There will also be $2,000,000 5 per cent first and refunding mortgage bonds issued. Some of the preferred will be exchanged for the shares of the companies to be acquired.

A Holding Company for Insull Interests.—Announcement has been made of the formation of a new holding company to be known as the Middle West Utilities Company. The company will be dominated and operated by Samuel Insull, of Chicago, and will have no connection with either the Commonwealth Edison Company of Chicago or the Public Service Company of Northern Illinois. The new organization is financed by Mr. Insull and his associates in England and the United States. At the outset the stock outstanding will amount to about $10,000,000, of which $6,000,000 will be common and $4,000,000 in 6 per cent preferred. The money arranged for has been subscribed 25 per cent in England and 75 per cent in this country. Several properties owned and contolled by Mr. Insull are to be turned over to the new holding company, for which properties he is to receive payment in the shape of common stock of the Middle West company. The operations of the new company will be devoted to the purchasing and reorganizing of local utility companies, and it is understood that some of the properties to be thus included in the holding company are now operating in Vermont, New Hampshire, Indiana, Illinois, Kentucky, Missouri and Michigan. Contrary to several newspaper reports, H. M. Byllesby & Company have no interest in the Middle West Utilities Company. No bond issue is contemplated for the new corporation.

Westchester Street Railway to Issue Common Stock.—The Public Service Commission for the Second District of New York has authorized the Westchester Street Railroad Company to issue its common capital stock to the amount of $434,000, the proceeds to be used for the purchase of parts of the Tarrytown, White Plains & Mamaroneck Railroad, now a part of the Westchester Street Railroad system, and for the necessary expenses attendant upon the purchase of this property. The commission has also authorized the New York, New Haven & Hartford Railroad Company to acquire and hold all the capital stock of the Westchester Street Railroad Company. The Westchester Street Railroad Company is also authorized to make a mortgage upon all its property, rights and franchises and secure the issue of bonds to the amount of $2,000,000 and to issue its thirty-year gold bonds to be sold at par and the proceeds to be used in payment for the acquisition of property and improvement of the facilities of the company. A large number of improvements have already been made.

Negotiating for Control of Louisville Companies.—The success of the plan for securing control of the Louisville Gas Company and its subsidiary, the Louisville Lighting Company, of Louisville, Ky., by H. M. Byllesby & Company, of Chicago, and William P. Bonbright & Company, of New York, now seems to be assured. The Byllesby interests obtained 6000 shares of stock several months ago when a pool of the shares for the purpose of transfer was proposed. Recently 13,000 shares were secured by the trust companies, the sale of which will give the new owners 19,000 of the 36,000 shares of stock in the company. The city of Louisville owns 9250 shares of the stock, and it has been stated that this block is not for sale. However, it is generally believed that ultimately the city will dispose of its holdings in the company. The price being paid for the stock is $120 a share, and it is believed that the trust companies will be able to get a large part of the 8750 shares which yet remain unsold. In that event the new interests will control 74 per cent of all the stock.

Nevada-California Power Company Offering.—Denver interests are offering first-mortgage sinking-fund 6 per cent gold bonds of the Nevada-California Power Company, which owns and operates a hydroelectric system, including three plants aggregating 16,500 hp capacity on Bishop Creek, a tributary to the Owens River, in Inyo County, Cal., and has 350 miles of high-tension transmission lines covering a productive territory in Nevada and California. The ultimate proposed development on Bishop Creek is 34,600 kw, for which the company now owns available sites and controls the necessary water rights. The company's capitalization is as follows: Capital stock, fully paid, $5,000,000; authorized 6 per cent bond issue, $3,000,000; bonds retired by sinking fund to Dec. 31, 1911, $138,000; bonds outstanding Dec. 31, 1911, closed mortgage, $2,862,000. Gross earnings of the company in the year ended Dec. 31, 1911, were $772,235, net profits after charges were $371,512, and the surplus was $297,209, which compares with $268,468 in 1910.

Niagara, Lockport & Ontario Power Company to Increase Preferred Stock.—Application has been made to the Public Service Commission of the Second New York District by the Niagara, Lockport & Ontario Power Company for permission to issue $2,000,000 cumulative 6 per cent first preferred capital stock, the proceeds to be used to pay off $2,000,000 par value 5 per cent gold coupon notes maturing June 1, 1912. The Electric Power Securities Company, of Niagara Falls, has applied to the commission for authority to purchase 10,685 additional shares of stock of the Niagara, Lockport & Ontario company, which would give it more than a majority of all of the latter's outstanding stock. All of the capital stock of the Electric Power Securities Company is owned by the Westinghouse Electric & Manufacturing Company.

1911 Statement of Minneapolis General Electric Company.—Gross earnings of the Minneapolis General Electric Company in the fiscal year ended Dec. 31, 1911, were $1,459,567, which compares with $1,276,041 in 1910, and net earnings were $895,770, which compares with $783,394 in the preceding year. After deduction of charges, the balance available for dividends was $417,612, comparing with $402,872 in 1910. Preferred dividends were $60,000. A common dividend of 7¼ per cent, amounting to $211,764, was paid in 1911 as against a 6½ per cent dividend in 1910, amounting to $147,074, leaving a balance of $145,848 for reserves and depreciation in 1911, comparing with a balance of $195,798 in 1910.

Asheville (N. C.) Power & Light Issues.—The Electric Bond & Share Company, 71 Broadway, New York, has sold $1,100,000 first-mortgage thirty-year 5 per cent gold bonds of the Asheville Power & Light Company, of Asheville, N. C., to New York and Baltimore bond houses and has sold $500,000 7 per cent cumulative preferred stock of the same company to Boston interests. As noted in these columns April 6, the Asheville Power & Light Company is the successor to the Asheville Electric Company. Its $1,000,000 common stock is owned by the Carolina Power & Light Company, which is controlled by the Electric Bond & Share Company.

Status of Cleveland Electric Illuminating Sale.—Owing to the fact that Harrison Williams, of New York, did not succeed in securing the 80 per cent of common stock of the Cleveland Electric Illuminating Company for which he has been negotiating, as noted in these columns April 20, page 870, within the time limit set, another offer has been made, which differs from the original offer only in the extension of the time for acceptance to May 28, 1912, and agreement to purchase if 60 per cent of the stock is offered, instead of 80 per cent as proposed at first.

West Penn Traction & Water Power Company Will Be Formed.—Common stockholders of the West Penn Traction Company voted on April 24 to accept the plan of the American Water Works & Guarantee Company to form a new company, to be known as the West Penn Traction & Water Power Company, to which reference was made in these columns March 23. The new company will have $27,000,000 capital, of which $20,500,000 will be common stock and $6,500,000 will be preferred stock.

Northern Ohio Traction & Light to Issue Stock.—On April 24 the Ohio Public Service Commission authorized the Northern Ohio Traction & Light Company to issue $1,640,000 of the $2,000,000 additional preferred stock previously applied for. The proceeds are to be used for improvements that are now being made. Only about $1,000,000, it is understood, will be issued at this time.

North American Company to Retire Notes.—Announcement has been made that on and after May 1 the North American Company will pay at par and interest its outstanding collateral trust 5 per cent notes due May 1, amounting to about $1,910,000, at 30 Broad Street, New York. These notes are part of an issue of $2,500,000 made in 1907, of which $590,000 have been retired.

Portland (Ore.) Railway, Light & Power Notes Offered.—Philadelphia financial interests are offering two-year 5 per cent gold notes of the Portland Railway, Light & Power Company, of Portland, Ore., at 99¼ and interest. The notes are dated May 1, 1912, are due May 1, 1914, and are redeemable at 100 and interest upon sixty days' notice on or after Nov. 1, 1912.

United Railways & Electric Initial Dividend.—An initial dividend of 75 cents, or 1½ per cent, per share has been declared on the $15,000,000 common stock of the United Railways & Electric Company, of Baltimore. The dividend is payable May 10 to holders of record May 2.

Clarksville (Tenn.) Railway & Light Company Sold.—Montgomery, Clothier & Tyler, of Philadelphia, have purchased control of the Clarksville Railway & Light Company, of Clarksville, Tenn. It is understood that improvements will be made to the plant.

New England Telephone & Telegraph Annual Meeting.—The annual meeting of the New England Telephone & Telegraph Company will be held at 15 Dey Street, New York, on May 6, at 11 a. m.

MARKET PRICES.

	April 24.	May 1.		April 24.	May 1.
Allis-Chalmers	1	1	Mackay Companies..	83½*	83½*
Allis-Chalmers, pf..	4⅜	3⅛	Mackay Cos., pf.....	69¼	68½*
Amalgamated Cop...	82⅝	83⅜	Philadelphia Elec...	18¼	18⅜
Boston Edison.....285*		292	Western Union.....	84⅝	84
C'monwealth Edison.146*		146*	Westinghouse	77	76½
Elec. Storage Bty...	54¾	55¼	Westinghouse, pf....120½*		120
General Electric....170		169			

*Last price quoted.

Personal

Mr. Charles H. Keel, of the patent department of the General Electric Company, has recently been placed in charge of the Washington (D. C.) office of that company.

Mr. Ira G. Walborn, formerly assistant electrical superintendent of the Eastern Pennsylvania Railways Company, Pottsville, Pa., has been appointed full electrical superintendent.

Mr. W. C. Sharp has resigned as electrical superintendent of the Eastern Pennsylvania Railways Company, Pottsville, Pa., to become general superintendent of the Helena Light & Railway Company, Helena, Mont.

Mr. William Marconi sailed from New York on April 30 on the Kaiser Wilhelm II. Mr. Marconi will go to London and after a few days in that city will take a business trip to Paris. He expects to return to New York in the fall.

Mr. E. J. Edwards, associate engineer of the engineering department of the National Electric Lamp Association, read a paper on April 18 on "The Incandescent Lamp as a Station Load" before the convention of the Nebraska Electrical Association.

Mr. Louis Friedman, of the arc-lamp department of the Chicago office of the General Electric Company, addressed the Electric Club of that city on April 25 on the new street-lighting system for Chicago which is being installed by the Sanitary District.

Dr. George L. Hoxie, consulting electrical engineer, New York, delivered an address entitled "Rate Fixing for Electric Public Service Properties" before a recent meeting of the Engineers and Architects' Association of Southern California, at Los Angeles.

Mr. C. S. Walters, heretofore general manager of the Walla Walla Valley Railway Company, of Walla Walla, Wash., has been elected vice-president and general manager. The Walla Walla Valley Railway Company is a subsidiary of the Pacific Power & Light Company.

Mr. D. F. McGee, chief engineer of the Pacific Power & Light Company, has been elected vice-president of the Hanford Irrigation & Power Company, an affiliated company, and will have charge of the operation and construction of this company in addition to his other duties.

Mr. Edd. N. Watkins, of Tacoma, Wash., is the subject of an article in the *Tacoma Tribune* of April 21, 1912. According to this article, Mr. Watkins arrived at Tacoma three years ago almost penniless and looking for a position. To-day he is sole proprietor of the Home Electric Company of Tacoma, a jobbing concern the trade of which extends to all parts of the State.

Mr. J. E. Davidson, heretofore general manager of the Pacific Power & Light Company, has been elected vice-president and general manager of that company, and Lewis A. McArthur, heretofore assistant treasurer, has been made assistant to the general manager. Mr. George L. Myers has been elected assistant secretary and assistant treasurer. All these officials have their headquarters in Portland.

Mr. Etienne de Fodor, director general of the Budapest General Electric Company, has been presented by King Francis Joseph of Hungary with the Komthur Cross of the Francis Joseph Order, in recognition of the extraordinary services rendered by Mr. de Fodor to his country in regard to engineering. Mr. de Fodor is the first electrical engineer in Hungary to be honored in this manner.

Mr. E. J. Richards, at one time general superintendent of the Newburgh (N. Y.) Light, Heat & Power Company, and more lately in the position of general superintendent of the Connecticut Power Company, with headquarters at Fitchburg, Mass., is severing this connection on account of the recent changes in the management of the property. Mr. Richards is widely known as a successful central-station manager.

Mr. David Gibson, of Cleveland, will address the Electric Club of Chicago, on May 9 on "The Morals of Efficiency." Mr. Gibson, who is spoken of as the dean of the literature of business in America, comes to Chicago with a reputation as an exceptional man, both as a speaker and a writer, and the club is congratulating itself on having the opportunity of listening to him. He is the editor and publisher of twenty-three monthly magazines, chiefly house organs of large commercial institutions.

Mr. David B. Rushmore, of the engineering department of the General Electric Company, sailed on April 27 for Porto Rico, where he is interested in citric-fruit enterprises. There is now a project on foot to establish in the mountains of that beautiful island a club for engineers, to be used more particularly during the winter season when so many people go to the West Indies for a vacation or to escape the rigors of the North, and Mr. Rushmore is taking an active part in the study and development of plans for putting the idea into effect. He will probably be gone about three weeks.

Mr. A. S. Grenier, who for the past two years has been connected with the Pacific Power & Light Company, of Portland, Ore., in the capacity of vice-president in charge of operation and construction, has been appointed assistant to the president of the American Power & Light Company, of 71 Broadway, New York, and has left for the East to take up his new duties. The American Power & Light Company is interested in the Pacific Power & Light Company and other public service organizations in the West. Previous to his connection with the Pacific Power & Light Company Mr. Grenier was associated with Trowbridge & Niver, of Chicago.

Obituary

Mr. Hinsdill Parsons, vice-president and general counsel of the General Electric Company, was instantly killed near Albany, N. Y., Sunday afternoon, April 28, as the result of an automobile accident. He was born in Hoosick Falls, Feb. 10, 1864, and received his higher education at Trinity College and at the Albany Law School, graduating from the latter in 1885. Four years later he was appointed patent attorney for the Walter A. Wood Harvester Company, of Hoosick Falls. He became associated with the General Electric Company in January, 1894, and in April, 1901, he was elected vice-president. Although only forty-eight years of age, Mr. Parsons had shown himself to be one of the ablest corporation lawyers in the country, his abilities having been well proved in the solution of the many perplexing legal problems which naturally arose in the development of the rapidly growing company of which he was general counsel. In 1907 Mr. Parsons took a very active part in the work of the rehabilitation of the Knickerbocker Trust Company, later becoming one of its directors—a position from which he subsequently retired. He was largely responsible for the remarkable development of the Schenectady Railway Company, the Schenectady Illuminating Company and the Mohawk Gas Company, being president of the last two companies at the time of his death. He was a director of the Electric Bond & Share Company, the Washington Water Power Company and the Schenectady Power Company. He maintained a residence in Schenectady, where he spent considerable time during the summer, but his business affairs kept him in New York City much of the time. Mr. Parsons was a member of the Mohawk Club and the Mohawk Golf Club of Schenectady and was deeply interested in many other local organizations. He was also a member of the University, Metropolitan, St. Andrew's and St. Nicholas Clubs and of the Down Town Association in New York City. He had a wide circle of friends among the leading legal and electrical men of the country, who mourn his loss. He leaves a widow, but no children.

HINSDILL PARSONS.

Construction

ALVISO, CAL.—The Sierra & San Francisco Pwr. Co. has petitioned the State Railroad Commission for approval of its application for franchises to construct a transmission line from Alviso, Santa Clara County, to Salinas, Monterey County.

ANAHEIM, CAL.—William Gerdes is at the head of a company which proposes to build a network of interurban lines having Anaheim as a center. The new company has no connection with the Pacific Electric system.

BURBANK, CAL.—Bids will be received by the city clerk until May 25 for the sale of a franchise to construct and operate an electric light and power station in Burbank for a period of 40 years.

COLUSA, CAL.—The Moulton Irrigated Lands Co., W. K. Brown, manager, will install pumps, motors and transformers on a barge to pump water for irrigating purposes.

DORRIS, CAL.—The Siskiyou El. Lt. & Pwr. Co. is improving its system here. Bert Coburn is local manager of the company.

GLENDALE, CAL.—The municipal lighting system has taken over that portion of the system of the Glendale Lt. & Pwr. Co., owned by L. C. Brand, which covers those sections known as West Glendale, Casa Verdugo and North Glendale. The price paid for the system was $12,900. Work will start within a few days on the city's ornamental electric street-lighting system.

GRASS VALLEY, CAL.—The Pacific Gas & El. Co. is preparing to raise the dam at Lake Spaulding 125 ft. and will also build a 7000-ft. tunnel to connect with the large storage lake.

JASPER POINT, CAL.—Arrangements are being made by the Merced Stone Co. for the construction of a new electric substation to replace the one recently destroyed by fire.

KING CITY, CAL.—The Coast Valley Gas & El. Co., a subsidiary of the Sierra Pwr. Co., has applied to the State Railroad Commission for permission to purchase the stock of the King City Wtr., Lt. & Power. Co. at $41,200.

MARYSVILLE, CAL.—The city is contemplating the purchase of the Pacific Gas & El. Co.'s local distributing system. Power will be obtained from the present owners in wholesale quantities. The present system will be improved.

MARYSVILLE, CAL.—The Pacific Gas & El. Co. has offered to replace the arc lamps in one of the arches on D Street with 25-watt tungsten globes, to show that the city can save about $30 per month by using the tungsten lamps. If satisfactory, the city will purchase the lamps for all the arches.

MERCED, CAL.—Work has been begun by the Merced River El. Co. on the construction of a dam across the Merced River above El Portal, just outside of the National Park line. From the dam the water will be flumed to Moss Canyon, 3 miles below, where the power plant will be erected. The first installation will provide for 4000 hp. It is proposed ultimately to develop 50,000 hp. The company later expects to install power pants at South Fork and Sweetwater.

NAPA, CAL.—The Board of Supervisors has granted the Great Western Pwr. Co. a franchise to erect transmission lines in Napa County.

ORLAND, CAL.—The Pacific States Tel. Co. will extend its system to the homes of the farmers in Orland.

RED BLUFF, CAL.—At the annual meeting of the Victor Pwr. Co. it was decided to increase the capital stock from $250,000 to $500,000. J. H. Sharp, P. H. Coffman, G. C. Garrett, A. F. Fletcher and Alex. Buick were elected directors for the ensuing year.

SAN FRANCISCO, CAL.—The steam railroad which climbs Mount Tamalpais will soon be equipped for electrical operation. The capital stock of the company owning the railroad is to be doubled and electric equipment secured. A large searchlight at the top of the mountain is also among the improvements to be added.

STOHLMAN, CAL.—The Northern El. Co. has purchased the Stohlman property, just east of Butte Slough, which will be used as a station. It is expected that the company will locate its main substation at Stohlman.

SUISUN, CAL.—Preparations are being made by the Pacific Gas & El. Co. for rebuilding its distributing system in this city.

SYCAMORE, CAL.—The Northern El. R. R. Co. will commence construction work at once on the Marysville-Colusa branch in Colusa County.

VALLEJO, CAL.—The City Council has granted the Great Western Pwr. Co. a temporary franchise to erect transmission lines to supply electricity here. The company asked for a 35-year franchise.

TRUMBULL, CONN.—Plans are being prepared by E. G. Southey, architect for the construction of a new power house for Charles P. Noyes in Trumbull. The proposed plant will supply electricity for lighting the Noyes homestead and adjoining buildings, and also for the new residence which is to be erected in the near future.

LAKE HELEN, FLA.—The proposition to issue bonds for the installation of municipal electric-light, water and ice plants will be submitted to a vote. A. D. Clarkson, care of Bond Sandstone Brick Co., Lake Helen, would like to correspond with contractors relative to installing same.

TAMPA, FLA.—The Tampa El. Co. has submitted a bid to the Board of Trade for the installation of an ornamental lighting system in the business district. The company agrees to furnish all material and equipment for the installation of 72 ornamental lamp standards carrying five-lamp clusters, the cost not to exceed $6,926. The cost of installation, including maintenance of lamps, for the first year is $10,166 and for the next five years $3,240 per year, making the total cost $26,366.

BOISE, IDAHO.—The Crane Falls Pr. & Irrig. Co. has ordered from the Westinghouse El. & Mfg. Co. three large electric motors, aggregating 5645 hp, nine control switchboards, and six 300-kw self-cooled transformers.

GRACE, IDAHO.—Extensive improvements are contemplated by the Telluride Pwr. Co. to its plant at Grace on the Bear River. The company has selected another site on the Bear River, at Oneida, which it is expected will be placed in commission within three years, supplying another 36,000 hp.

CHICAGO, ILL.—The Illinois Northern Utilities Co. has increased its capital stock from $1,000 to $20,000,000, the proceeds to be used to acquire a group of electrical properties in northern Illinois controlled by the Insull interests.

STERLING, ILL.—The capital stock of Illinois Northern Utilities Co. has been increased from $1,000 to $20,000,000. The headquarters of the company will be located in Sterling and Rock Falls, where the Sterling Gas & El. Co. now operates, and where there are valuable water-power rights along the Rock River. Other gas and electric properties along the Rock River Valley will be taken over.

BLUFFTON, IND.—The Marion, Bluffton & Eastern Ry. Co. and the Bluffton, Geneva & Celina Trac. Co. have submitted a proposition to the City Council offering to take over the municipal electric-light plant. The traction companies ask for a franchise for furnishing electricity for lamps and motors in Bluffton and to purchase the municipal plant at a price to be established by a board of three appraisers.

FORT WAYNE, IND.—The receivers of the Wabash R. R. Co. have authorized the installation of three telephone lines to be used for business purposes, but not for dispatching trains. One will run from St. Louis to Chicago, one from St. Louis to Detroit, and one from St. Louis to Moberly.

MICHIGAN CITY, IND.—The contract for installing a boulevard lighting system on Franklin Street, consisting of 117 lamp standards carrying five-lamp clusters and about 8000 ft. of underground wiring, has been awarded to W. E. Sheeler, of Michigan City, for $9,256.

NORTH MANCHESTER, IND.—The Brown-Mills Co., North Manchester, has been awarded a contract for lighting the streets of the town for a period of five years. The contract calls for both arc and incandescent lamps.

RICHMOND, IND.—The installation of an ornamental street-lighting system in the business district is under consideration.

CARROLL, IA.—A committee has been formed to solicit subscriptions for the purpose of installing an electrolier lighting system in the business district of the city. It is proposed to erect 47 lamp stands. F. B. Nockels is interested.

CHARLES CITY, IA.—The City Council will soon call an election to vote on the proposition to issue $25,000 in bonds for the installation of a municipal electric-light and pumping plant.

COLUMBUS JUNCTION, IA.—E. N. Miller has been granted a franchise to install and operate an electric-light plant here.

DAYTON, IA.—The Central Iowa Lt. & Pwr. Co., Fort Dodge, has applied for a franchise to supply electricity for lamps and motors here.

GLADBROOK, IA.—Application has been made to the Council by Mr. Ageton, of Tama, Ia., for an electric-light franchise here.

HEDRICK, IA.—If granted a franchise for street-lighting here, J. O. Martinsburg proposes to erect an electric plant.

HEDRICK, IA.—The Sigourey El. Lt. Co. has applied for a franchise to extend its lines to supply electricity for lamps and motors here.

HUMESTON, IA.—An election will be held to vote on a $15,000 bond issue for the installation of an electric-light plant.

OSAGE, IA.—Owing to the dam at the electric plant having given out, Ferris Brothers, owners of the plant, have purchased a site and will erect a new steam plant. A dam will be built as soon as the steam plant is completed. The company will also establish a day service.

ROLFE, IA.—Application has been made to the Town Council by Mr. Wilkins, of the Rumboldt Pwr. Co., to supply electricity here.

WEBSTER, IA.—Plans are being considered by the Fort Dodge, Des Moines & Southern Interurban Co. for equipping the Crooked Creek line for electrical operation. John L. Sullivan is general manager.

AUGUSTA, KAN.—Estimates are being asked by the city of Augusta for an electric-light plant. J. R. Switzer is city engineer.

AXTELL, KAN.—A special election will soon be held to vote on the proposition to issue bonds for the installation of an electric-light plant.

COFFEYVILLE, KAN.—At an election held April 9 bonds to the amount of $130,000 were voted for improvements to electric-light plant and water-works system, consisting of one 300-kva turbo-alternator with condenser and auxiliaries; two 3000 g. p. m. low-service centrifugal pumps direct-connected to 75-hp slip-ring induction motors; one 3000 g. p. m. high-pressure centrifugal pump direct-connected to a 200-kva synchronous motor; two 25-kva, two 125-kva and two 175-kva, 11,000-

volt transformers, poles, wire and line material; also mechanical equipment for a 6,000,000-gal. filtration plant for 4,000,000 gals. installed; 2,000,000-gal. settling basin; 250,000-gal. clear-water basin, dam and intake crib; approximately 8 miles cast-iron pipe of various sizes from 4 in. to 16 in.; approximately 100 gate valves and 10 fire hydrants.

MILTONVILLE, KAN.—A franchise has been granted to H. W. Chapman to construct and operate an electric-light plant here for a period of 20 years.

NORTON, KAN.—The Norton Lt., Ice & Cold Storage Co. has submitted a proposition to the Council offering to sell its plant to the city.

OLATHE, KAN.—Bids will be received by the State Board of Control, Topeka, Kan., until May 7 for the installation of a 30-kw direct-current generator direct-connected to a 50-hp side-crank, high-speed engine at the School for the Deaf, Olathe, Kan., in accordance with plans and specifications prepared by Charles H. Chandler, state architect.

TURON, KAN.—The question of establishing an electric-light plant in Turon is being agitated.

BOWLING GREEN, KY.—A company is being organized by D. Y. Johnson, of Nashville, Tenn., for the purpose of building a hydroelectric power plant on the Barren River, near Bowling Green, to supply electricity for the large stone quarries in this district.

NICHOLASVILLE, KY.—The Kentucky Trac. & Terminal Co. has purchased a site on which it proposes to erect an electric substation.

BOSTON, MASS.—Bids will be received until May 10 by the Park Commissioners, Robert S. Peabody, chairman, for wiring for the electric lamps on Prince Street playground.

FALL RIVER, MASS.—The stockholders of the Fall River El. Lt. Co. have voted to sell its power house in this city to the Southern Massachusetts Pwr. Co.

HOLYOKE, MASS.—Plans and specifications are being prepared for laying underground conduits for electric wires in the business section of the city.

PALMER, MASS.—The Central Massachusetts El. Co. is planning extensive improvements to its plant at Blanchardville, which will include rebuilding the plant. The present equipment will be removed, the flume rebuilt, and three new waterwheels will be installed to drive three new generators.

STONEHAM, MASS.—Arrangements are being made to place the wires of the Edison Illg. Co. and the Bay State St. Ry. Co. in Central Square in underground conduits.

GRAND RAPIDS, MICH.—The Commonwealth Pwr. Co. is planning extensive improvements to its system in this State this year, which will involve an expenditure of $3,400,000. The improvements will include a second dam on the Au Sable River, a new power station at Battle Creek and the erection of a duplicate transmission line from the Muskegon junction of the power company to this city.

HOUGHTON, MICH.—Plans are being considered by the Houghton Business Men's Association for the installation of an ornamental street-lighting system on Sheldon Street.

BIG FALLS, MINN.—The Village Council has granted Messrs. Dahl & Shipley a 25-year franchise to install and operate an electric-light plant at Big Falls. The Council has agreed to enter into a contract for street lighting to cost not less than $500 per year.

BIWABIK, MINN.—The contract for the installation of 21 ornamental lamp standards for arc lamps has been awarded to the Flour City Ornamental Iron Works, Minneapolis, at $33 each. The cost of the system complete is $3,547.

COLD SPRING, MINN.—Application has been made to the Council by Henry Witt, representing the Lethert Elecl. Co., of St. Paul, for a franchise to install an electric-light system here.

EAST GRAND FORKS, MINN.—The city is planning to erect ornamental street lamps on De Mers Avenue, to cost about $4,000, for which bids will soon be asked.

NORTHFIELD, MINN.—The Dan Patch El. Co. is planning to build an electric plant at Antlers Park this summer. A depot will be erected on the site of the present one. The present plans call for 50 arc and 1200 incandescent lamps for the park.

WILLMAR, MINN.—The Water and Light Commission contemplates making recommendations to the City Council for improvements to the municipal electric-light plant, including a complete overhauling of the transmission lines and possibly the installation of an additional engine and generator.

RICHTON, MISS.—The Richton Lumber Co. is planning to make improvements to its plant, including the installation of an electric plant to supply electricity to the mill and the city. The work will cost about $60,000.

SUMNER, MISS.—An election will be held May 6 to submit the proposition to issue $22,500 in bonds for the installation of an electric-light plant and water-works system to the voters. A. L. Whitten is Mayor.

CLARKSDALE, MO.—The proposition for the installation of an electric-light plant was carried.

JEFFERSON CITY, MO.—It is reported that steps have been taken by R. W. Morrison, of St. Louis, in regard to securing legislation on a $5,000,000 water-power project on the Osage River to furnish electricity for lamps and motors to the Central Missouri region, between Jefferson City and Kansas City, reaching Sedalia, Warrensburg and other points. It is estimated that 65,000 hp could be developed in the Osage River by erecting a large reservoir. It is proposed to build one dam at Baynell, in Camden County, and another above Warsaw. Col. John A. Laird, of St. Louis, will be engineer.

KANSAS CITY, MO.—Estimates will soon be asked by the Park Board for 105 iron lamp standards for Swope Park.

MILES CITY, MONT.—A proposition has been submitted to the City Council by B. S. Hill, C. C. Cragin and M. E. Brookman, of Mobridge, for the purchase of the municipal electric-light plant. They offer to purchase the plant and supply the city with electricity for lamps and motors at half the rates now paid, if granted a 25-year franchise. It is proposed to develop the power at Buffalo Rapids, 10 miles from the city.

IMPERIAL, NEB.—Application has been made to the Village Board by G. W. Brown for a franchise to construct and operate an electric-light plant here.

KEARNEY, NEB.—Bids will be received by the city of Kearney until May 22 for the installation of a municipal electric-light plant. The work consists approximately of the following: Brick power station; one 95-hp or 120-hp fuel-oil engine or gas-producer plant; one 60-kw or 75-kw generator; transmission lines, consisting of 870 poles, 176,000 ft. of No. 8 weatherproof wire, also about 6000 ft. of three-conductor cable; 60 ornamental lamp standards carrying five-lamp clusters and 122 cross suspensions; 122 bracket lamps. Plans and specifications may be seen at the office of the Oscar Claussen Engrg. Co., St. Paul, Minn., or at the office of George E. Ford, city clerk. Additional copies may be secured from the engineer at $5 per set.

OMAHA, NEB.—The contract for construction of a substation and power plant at Forty-eighth and Leavenworth Streets for the Omaha Lt. & Pwr. Co. has been awarded to Bridges, Hoyes & Co.

FREEHOLD, N. J.—The installation of a municipal electric-light plant is under consideration. It is probable that an election will soon be called to vote on a $50,000 bond issue to build the plant.

ORANGE, N. J.—The City Council is considering the question of enlarging the municipal electric-light plant to supply electricity for commercial purposes. Henry M. Berg, chief engineer of the plant, has been authorized to prepare estimates of cost of same.

TRENTON, N. J.—The Public Service Corpn. has submitted plans to the City Commissioners for the installation of a new street-lighting system for the center of the city. The plan calls for ornamental poles set 100 ft. apart with wires underground.

FORT BAYARD, N. M.—Proposals will be received by Captain G. H. Scott, quartermaster, Fort Bayard, until May 15 for furnishing two boilers, two generators and engines. Bids are also wanted on a switchboard complete for two generators, two ice machines, 99 ice cans and two steam pumps.

ALBANY, N. Y.—The Governor has signed a bill appropriating $195,000 for the construction and equipment of the Capitol power plant.

COHOCTON, N. Y.—The Village Board has awarded the contract for lighting the village by electricity. A substation will be erected here.

LESTERSHIRE, N. Y.—The proposition to issue $9,500 in bonds for the construction of a conduit system in Main Street will soon be submitted to a vote.

LEWISTON, N. Y.—The Public Service Commission has authorized the Lewiston & Lake Ontario Shore Pwr. Co. to exercise franchises and to furnish electricity in the villages of Lewiston and Youngstown. The company is also granted permission to issue capital stock to the amount of $25,000, the proceeds to be used for the erection of a transmission line, substation and distributing system.

NORWOOD, N. Y.—The Northern Pwr. Co., Pottsdam, has applied to the Public Service Commission for permission to supply electricity here.

RICHMOND, S. I., N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until May 9 for furnishing materials and construction of a nurses' home and headquarters, two ward pavilions and corridors, including heating and ventilating work, refrigerating and electric work, culinary and other apparatus for the surgical pavilion, dining hall and kitchen building; also for an independent power plant and laundry machinery plant, etc., for the Sea View Hospital, Manor Road, borough of Richmond. Blank forms and further information may be obtained at the office of Raymond F. Almirall, architect, 185 Madison Avenue, New York. Michael J. Drummond is commissioner.

NEWBERN, N. C.—Bids will be received for furnishing incandescent lamps (both gem and carbon) for the Water and Light Department for 12 months. T. F. McCarthy is chairman of the water and light committee.

JAMESTOWN, N. D.—Preparations are being made for the installation of an ornamental street-lighting system in the business district, bids for which will be received until May 27.

RAY, N. D.—The Williston El. Construc. Co., of Williston, has been granted a franchise to construct and operate an electric-light plant here.

VALLEY CITY, N. D.—Bids will be received by the City Council until May 6 for material and posts for the installation of an ornamental street-lighting system in Valley City. M. J. Boyd is city auditor.

NEWARK, OHIO.—The Licking Lt. & Pwr. Co. has taken an option on a tract of land in the southeastern part of the city on which, if

purchased, it proposes to erect a new power plant in the near future. H. L. Montgomery is manager.

SANDUSKY, OHIO.—An election will probably be called soon to vote on the proposition of issuing $175,000 to $200,000 in bonds for the construction of a municipal electric-light plant. R. L. J. Wagor is city engineer.

PONCA, OKLA.—It is understood that bids will soon be asked by the city for the construction of a municipal electric-light plant, for which $30,000 in bonds have been voted. Burns & McDonnell, Kansas City, Mo., are engineers.

WAGONER, OKLA.—Bids will be received by the city clerk until May 14 for the construction of an electric-light plant and water-works system, from plans of the Benham Eng. Co., American National Bank Bldg., Oklahoma City.

KLAMATH FALLS, ORE.—The Pacific Tel. & Tel. Co. will soon begin the construction of a new telephone system for Klamath Falls.

LA GRANDE, ORE.—The Eastern Oregon Lt. & Pwr. Co. has been awarded franchises at Elgin, Imbler and Alicel, Ore., and will extend its lines to these places.

PENDLETON, ORE.—John T. Whistler, engineer, has submitted his report on the power site on Walla Walla River, upon which the city has an option which it intends to develop to supply power for a municipal electric plant. He estimates the cost of the erection of a transmission line from the power plant to Pendleton and of a distributing system in the city at $55,000.

PORTLAND, ORE.—D. P. Donovan has filed on an important power site near Portland, having secured the right to 1200 sec. ft. of water under a head of 110 ft. It is to be developed soon.

PORTLAND, ORE.—The Northwestern El. Co., which recently applied for a franchise, has purchased two blocks on the east side of Portland for $450,000, and will erect a central station.

PORTLAND, ORE.—The Southern Pacific R. R. Co. has purchased six acres of land at Oswego, Ore., and will erect car shops for the West Side electric service. A route is also being surveyed to Astoria, Ore., to compete with the Hill company's lines. An appropriation of $1,600,000 has been made for equipping the West Side lines for electrical operation. D. W. Campbell is superintendent of the company.

ASHLEY, PA.—Sealed proposals will be received by the Borough Council until May 15 for lighting the streets of the borough with electric arc and incandescent lamps for alternate periods of three, five and seven years. Copies of specifications may be obtained from the office of John B. Wallis, Jr., secretary, 103 North Main Street.

EBENSBURG, PA.—The Borough Council has granted the Cambria Township Lt., Ht. & Pwr. Co. a franchise to supply electricity for lamps and motors here. T. Stanton Davis is interested in the company.

HARRISBURG, PA.—Application will soon be made to the State for a charter for the West Branch Lt. Co., West Branch Fuel Co., Southern Lt. Co., Southern Fuel Co., Union County Lt. Co. and Union County Fuel Co., by Walter P. Maguire, William T. Voll, and George D. Umholtz, of Harrisburg. The companies will supply light and fuel in the vicinity of Williamsport.

MIDLAND, PA.—The capital stock of the Midland El. Lt. & Pwr. Co. has been increased from $5,000 to $50,000.

PINE GROVE, PA.—A proposition has been submitted to the Borough Council by Mr. Tropell, of Bloomsburg, asking for a 15-year franchise to build and operate an electric-light plant in Pine Grove.

PITTSBURGH, PA.—Bids will be received at the office of the city controller until May 7, 1912, for construction of underground conduit along Carson Street and streets adjacent thereto, between Smithfield and South Sixteenth Street. Plans, specifications, blank proposals, etc., may be secured at the office of R. J. Duley, superintendent of Bureau of Electricity, Public Safety Building, Pittsburgh, Pa.

PITTSBURGH, PA.—The stockholders of the West Penn Trac. Co. have decided to accept the proposition of the Amerian Wtr. Wks. & Guarantee Co. to organize a new company to be known as the West Pennsylvania Trac. & Wtr. Pwr. Co., to be capitalized at $27,000,000. The new company will carry out the undertaking of the Cheat River Hydro-Electric Co. for constructing a hydroelectric plant on the Cheat River in West Virginia.

SUMMERVILLE, PA.—The Summerville Tel. Co. has increased its capital stock from $30,000 to $50,000.

YEADON, PA.—The Borough Council has awarded the Delaware County El. Co. a five-year contract for street lighting, to take effect June 15. The company will rebuild its distributing system throughout the borough.

LEAD, S. D.—Work has commenced on changing the equipment of the Homestake Mining Co. from steam to electric operation. Electricity for operating the plants will be secured from the large hydroelectric plant in Spearfish Canyon. The company expects soon to begin work on the construction of a steam-driven auxiliary plant for use in emergencies. The cost of the entire electric project is estimated at $1,000,000.

CENTERVILLE, TENN.—The construction of a hydroelectric plant near here is under consideration by John W. Frye and others, of Centerville.

CENTERVILLE, TENN.—C. F. Keifer, representing Cincinnati interests, is negotiating for sites along Duck River, in the vicinity of Centerville. His plans are said to be in connection with an interurban project.

DALLAS, TEX.—Work has begun on preparing estimates for the installation of a new street-lighting system for the city, consisting of 1500 arc lamps. Estimates will also be made as to the cost of putting the wires underground on Main, Commerce and Elm Streets and intersecting streets from Pearl Street to Trinity.

DALLAS, TEX.—The Board of Municipal Commissioners has passed an ordinance requiring the Southwestern Teleg. & Tel. Co. to place its wires in underground conduits on Lancaster Avenue in Oak Cliff, with certain laterals needed for distribution, and on Bryan Street from Garrett Avenue to Henderson Avenue, with necessary laterals.

NEW BRAUNFELS, TEX.—Sealed bids will be received by the city of New Braunfels, Tex., at the office of C. A. John, Mayor, until May 22, for construction and improvements to the municipal electric plant and water-works system, in accordance with plans and specifications prepared by the W. K. Palmer Co., and now on file at the office of the Mayor, New Braunfels, and the office of the engineers, 717 Dwight Building, Kansas City, Mo.

MURRAY, UTAH.—The City Commissioners have taken over the Joseph Ulmer and Despain water-power privileges in Littlewood, Cottonwood Canyon. It is understood that the city will develop same to provide power for a municipal electric light and power plant. An election will soon be held to vote on a bond issue to provide funds to complete the plant.

CLIFTON FORGE, VA.—Plans are being prepared for a water-power development on the Jackson River by the Clifton Forge Public Service Corpn. The company proposes to transmit electricity to Clifton Forge and Covington, Va. Francis R. Weller, Hibbs Building, Washington, D. C., is engineer.

DANTE, VA.—The Clinchfield Coal Corpn. contemplates the installation of three substations within three months at the central power plant in connection with its mines at Dante. Each station is to be equipped with two 300-kw motor generator sets. Additional boiler capacity will be required at the central station.

SEATTLE, WASH.—Arnold Co., consulting engineers, Chicago, Ill., has completed a report on a 70,000-hp hydroelectric development on Sultan River, about 30 miles east of Everett, for the Washington Ry. & El. Co. The project includes wire dams, providing a total head of 1200 ft. and a storage capacity to give a constant flow of 585 sec. ft. Preliminary surveys have not yet been completed. E. B. Caldwell, Detroit, Mich., is president.

SOUTH BEND, WASH.—The installation of an ornamental street-lighting system on Water Street is under consideration. Ornamental standards carrying three-lamp clusters are proposed.

OAKFIELD, WIS.—The Oakfield El. Lt. Co. is planning to install a storage battery plant.

SUPERIOR, WIS.—The directors of the Superior Wtr., Lt. & Pwr. Co. have authorized an issue of bonds to provide funds for extensions and improvements to its system this summer. Thomas B. Scott, Burkeville, Va., is president.

NEW WESTMINSTER, B. C., CAN.—A by-law appropriating $25,000 for extensions to the electric-light system has been approved by the ratepayers.

CLINTON, ONT., CAN.—Estimates have been prepared by Messrs. Yates and Acres, of the Hydro-Electric Commission, for furnishing several municipalities in Huron County with power developed on the Maitland River. It is estimated that a maximum of 5000 hp can be developed, and the minimum is placed at 1000 hp. It is proposed to operate the system in conjunction with Niagara power at Seaforth, about 15 miles from the proposed plant. The cost of the development is estimated at $586,000. If it is decided to build the plant, it is proposed to erect a transmission line from Seaforth to Goderich at once and use the power on the construction of the new plant.

THORNDALE, ONT., CAN.—The by-law in favor of securing electricity from the Hydro-Electric Commission has been approved by the ratepayers.

MONTREAL, QUE., CAN.—Tenders have been asked by the Cedar Rapids Mfg. & Pwr. Co. for the first contract for its proposed plant, consisting of the construction of the dike and part of a power house, the cost of which is estimated at about $2,000,000.

New Industrial Companies

THE PUBLIC SERVICE SALES COMPANY, of Newark, N. J., has been incorporated with a capital stock of $2,500,000 to deal in electric and gas appliances. The incorporators are: G. J. Roberts, East Orange; J. J. Burleigh, Merchantville; E. W. Hine, P. Ingalls, Orange, and J. P. Dusenberry, Newark.

THE THERMO TURBINE COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $500,000 by G. O. Newman, A. Wilston and F. C. Collie.

THE TRACTION APPLIANCE COMPANY, of Vincennes, Ind., has been granted a charter with a capital stock of $35,000 for the purpose of manufacturing appliances and equipment of all kinds for the generation and use of electricity, gasoline and other forms of motive power for pro-

pelling cars, trucks, vehicles, machinery, etc. The directors are: Fred C. Morgan, Joseph J. Risch and George E. Henry.

THE TRENTON ELECTRIC & CONDUIT COMPANY, of Trenton, N. J., has been granted a charter with a capital stock of $25,000 for the purpose of manufacturing electrical supplies, metallic and porcelain conduits, switchboards, etc. The incorporators are: L. Alpaugh, C. J. Alpaugh and E. A. Alpaugh, of Trenton.

THE UNIVERSAL ELECTRIC ECONOMY COMPANY, of Montreal, Que., Can., has been incorporated with a capital stock of $50,000. The company proposes to do a general electrical engineering and contracting business and to deal in railway, electrical, magnetic and other apparatus. The incorporators are: C. V. Cousins, A. H. Elder and S. T. Mains, all of Montreal.

New Incorporations

MALVERN, ARK.—The Ouachita Elec. Co. has been granted a charter with a capital stock of $50,000. The officers are: William Kilpatrick, president; W. R. Duffie, vice-president, and Orson Kilpatrick, secretary and treasurer. The company proposes to build a 30-ft. dam across the Ouachita River at the falls, 2 miles from the city.

WHITE RIVER JUNCTION, VT.—Articles of incorporation have been filed for the Mascoma Lt. & Pwr. Co. under the laws of the State of Maine, with a capital stock of $500,000. The company proposes to take over the properties of the Hartford Wtr. Pwr. Co., which furnishes water-power to West Lebanon, N. H., and White River Junction, Vt., and the Mascoma El. Lt. & Gas Co., which furnishes electricity in West Lebanon and Hanover, N. H., and White River Junction, Vt. The officers are: Charles L. P. Chase, Hanover, N. H., president; Thomas W. Streeter, Boston, Mass., vice-president; S. Reid Anthony, Boston, treasurer, and Frank Collins, West Lebanon, general manager.

CLARKSBURG, W. VA.—The Clarksburg & Philippi Trac. Co. has been granted a charter with a capital stock of $300,000 to build an electric railway from Clarksburg to Philippi and from Craigmoor to Buckhannon. The incorporators are: Thomas L. Nutter, Clarksburg; E. R. Dyer, J. C. Watson, R. J. Dunham, of Philippi; Charles C. Robb and J. P. Necessary, Fairmont, W. Va.

GASSAWAY, W. VA.—The Gassaway Tel. Co. has been incorporated with a capital stock of $10,000 by David Frame, C. W. Maple, Gassaway; May M. Frame, Sutton, and others.

Trade Publications

CARBON CIRCUIT-BREAKERS.—Folder No. 4049 issued by the Westinghouse Electric & Manufacturing Company covers type F carbon circuit-breakers. These breakers are intended for the protection of lighting circuits and small direct-current motor installations, being used to combine the functions of fuse and switch.

SEARCH-LANTERNS FOR COMMERCIAL USE.—Bulletin No. 4928 of the General Electric Company, devoted to commercial search-lanterns, describes not only the carbon arc projectors, but contains also illustrations and description of the incandescent lamp equipment just placed upon the market by the General Electric Company. The bulletin contains data relative to the subject which should be of great interest to yacht and motor-boat owners.

CRANE AND HOIST ELECTRICAL AUXILIARIES.—The type QK electrically operated brakes for direct-current crane and hoist motors are described and illustrated in Descriptive Leaflet No. 2446, issued by the Westinghouse Electric & Manufacturing Company. These brakes are described as being small, compact and entirely inclosed, with no exposed moving parts. A diagram of the brake is given and its principle of operation described. Descriptive Leaflet No. 2449 describes types 536 and 537 hand-operated controllers for light crane and hoist service. These controllers are built in sizes from ½ hp to 7½ hp. Type SP electrically operated brakes designed especially for mill and crane service, built in sizes of from 5 hp to 200 hp, are described in Descriptive Leaflet No. 2447 issued by the Westinghouse Electric & Manufacturing Company. Although designed for this class of service, they are also suitable for use with any direct-current motor. They are weatherproof and will withstand very severe service.

PRINCIPLES OF INDUSTRIAL LIGHTING.—Mr. George C. Keech, an illuminating engineer and Chicago representative of the Cooper Hewitt Electric Company, has compiled a pamphlet entitled "The Accepted Principles of Illuminating Engineering, with Special Reference to Industrial Lighting." The pamphlet is made up largely of extracts from the lectures given at Johns Hopkins University in November, 1910, under the joint direction of the university and the Illuminating Engineering Society. Practical suggestions are arranged under such headings as "Proper Location of Light Sources," "Distribution," "Glare and Field of Vision," "Intrinsic Brilliancy," "Intensity of Illumination for Various Purposes," "Color," "Reflection," etc. In addition to the material obtained from the Baltimore lectures, there are extracts from the book by Dr. Steinmetz on "Radiation, Light and Illumination" and from an article in the *Electrical World* by Dr. Louis Bell on "Chromatic Aberration and Visual Acuity." The pamphlet gives much practical information in convenient form. It contains several pictures of examples of factory lighting, and although the conclusions drawn are favorable to the mercury-vapor lamp, the compilation is of general interest. The pamphlet will be sent to anyone who is interested in the subject by application to the Cooper Hewitt Electric Company, Eighth Street and Grand Street, Hoboken, N. J.

Business Notes

RAY D. LILLIBRIDGE, INC., a firm which specializes in technical advertising, has moved its office to the Trinity Building, at 111 Broadway, New York.

HOXIE & GOODLOE, consulting electrical and mining engineers, have moved their New York office from 50 Church Street to 50 East Forty-first Street.

THE LORD MANUFACTURING COMPANY, formerly at 213 West Fortieth Street, New York, N. Y., has removed to Bush Terminal No. 7, Brooklyn, N. Y.

MR. RALPH D. MERSHON, consulting electrical and mechanical engineer, has moved his New York office to the building numbered 80 Maiden Lane and 19 Cedar Street.

W. L. FLEISHER & COMPANY, INC., have succeeded to the business of Francis Brothers & Jellett, New York. The company will maintain engineers' offices at 156 Fifth Avenue.

THE NEW YORK EDISON COMPANY has moved its second district office from its temporary location at 245 West Forty-second Street, New York, to its new building at 124 West Forty-second Street.

THE ELECTRIC SPECIALTIES COMPANY, New York, announces that Mr. Paul A. Curtis, Jr., late of the Bureau of Illumination of the New York Edison Company, has become associated with the company as illuminating engineer.

D. VAN NOSTRAND COMPANY.—The offices and salesrooms of the D. Van Nostrand Company, publishers of scientific and technical books, have been moved from 23 Murray Street and 27 Warren Street to 25 Park Place, New York City.

DIEHL MANUFACTURING COMPANY.—Owing to the increased business in the Southwest, the Diehl Manufacturing Company has opened a branch office at 1117 Olive Street, St. Louis. The office is under the management of Mr. L. W. Carnahan and will carry in stock all the Diehl apparatus.

THE MECHANICAL APPLIANCE COMPANY, of Milwaukee, manufacturer of the Watson direct-current and alternating-current motors, has completed the erection of a new office building adjoining its manufacturing plant. The office force and egineering department will be moved from the factory into the new building, and the extra space available will be used for manufacturing purposes. This change has been made necessary because of the extensions recently made in the line of alternating-current single-phase and polyphase motors.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, Lafayette, Ind., is now supplying the trade with a full line of alternating-current and direct-current watt-hour meters and is calling special attention to its new induction watt-hour meter, "Model M," which has a driving torque of 109 mm; also to its new "Model R" shunted type direct-current switchboard watt-hour meter. The latter is of the multipolar type and is guaranteed to be positively astatic. The Duncan company is also designing a full line of sign-lighting and bell-ringing transformers.

THE H. W. JOHNS-MANVILLE COMPANY MOVES TO LARGER QUARTERS.—The executive offices and New York showrooms of the H. W. Johns-Manville Company, manufacturer of asbestos, magnesia and electrical supplies, were moved on April 20 to the new twelve-story "H. W. Johns-Manville Building," Madison Avenue and Forty-first Street, New York City, from its old quarters at 100 William Street, where the firm has been located for the past fifteen years. This move marks the fifty-fourth anniversary of the company. Under the name of H. W. Johns Manufacturing Company the business was conducted at 87 Maiden Lane previous to May 1, 1897, when it was moved to 100 William Street. In 1901 the firm name was changed to H. W. Johns-Manville Company, a consolidation being effected between the Manville Covering Company, of Milwaukee, Wis., and H. W. Johns Manufacturing Company. This last combination brought together two of the largest manufacturers of pipe and boiler coverings, packings, roofings, etc., in the world, and the growth of the company since that time has been almost phenomenal. Factories of the firm are now located in Brooklyn, N. Y., Milwaukee, Wis., West Milwaukee, Wis., Hartford, Conn., Nashua, N. H., Lockport, N. Y., and Newark, N. J., with an asphalt refinery at South Amboy, N. J., and extensive asbestos mines at Danville in the Province of Quebec, Canada, which are the largest in existence and produce an exceptionally fine grade of asbestos. There is also a branch house in every city of any size in the United States and Canada, and there are representatives in nearly all foreign countries. In the new quarters the company will have the distinction of being one of the few manufacturing concerns which occupy an entire twelve-story office building. In its entirety the company now occupies over 2,657,160 sq. ft. of floor space, or about 61 acres. The employees number approximately 5000 and there are about 425 salesmen.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary-Treasurer, Geo. S. Emery, 11 N. Royal St., Mobile, Ala.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Convention, Chicago, Ill., Oct. 7-11, 1912.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York. Convention, Richmond, Va., Sept. 3-5, 1912.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson. Engineering Societies Building, 29 West 39th St., New York. Meeting, second Friday of each month, excepting June, July, August and September. Annual meeting, Boston, Mass., June 25-28.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, E. H. Hardin, Hot Springs, Ark. Convention, Little Rock, Ark., May 20-22.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Seattle, Wash.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Colo.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, F. D. Morris, 323 Hagerman Building, Colorado Springs, Colo.

ELECTRIC CLUB, CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADE SOCIETY OF NEW YORK (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL VEHICLE ASSOCIATION OF AMERICA. Assistant Secretary, Harvey Robinson, 245 West 42d St., New York. Meeting, fourth Tuesday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC & RAILWAY ASSOCIATION OF OKLAHOMA. Secretary, H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Convention, Peoria, Ill., Aug. 26-30, 1912.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next meeting at Berlin in 1913.

IOWA ELECTRICAL ASSOCIATION. Secretary, A. L. Dodd, Charles City, Ia. Convention, Waterloo, Ia., April 23 and 24, 1913.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Annual meeting at Manhattan, Kan., Oct. 17-19, 1912.

LOUISIANA ELECTRICAL ASSOCIATION. Secretary, W. H. Bower Spangenberg, 627 Poydras St., New Orleans, La. Meets third Monday of each month.

MAINE ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. F. Strong, Chaska, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER WORKS ASSOCIATION. Secretary-Treasurer, P. W. Markham, Brookfield, Mo. Next convention at Mexico, Mo., 1913.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual convention at Detroit, Mich., June 25-27, 1912.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next annual convention, July 17-19, 1912, Denver, Col.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., June 10-13, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can. Convention, Ottawa, Ont., June 19-21, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, P. S. Dodd, 1823 E. 45th St., Cleveland, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, W. A. Wadsworth, Schenectady Illuminating Company, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, T. W. Peters, Columbus Railway Company, Columbus, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Convention, June 21-25, S.S. *Majestic*.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss. Convention, Vicksburg, Miss., May 28-30.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW HAMPSHIRE SECTION.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

NATIONAL ELECTRIC LIGHT ASSOCIATION, PENNSYLVANIA SECTION. Secretary-Treasurer, W. E. Long, Philadelphia, Pa.

NATIONAL ELECTRIC LIGHT ASSOCIATION, POWER TRANSMISSION SECTION. Secretary, D. B. Rushmore, 234 Union St., Schenectady, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Bldg., Chicago.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, W. L. Smith, Concord, Mass.

NATIONAL ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual meeting, Breakers Hotel, Cedar Point, Ohio, July 16-19, 1912.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

PITTSBURGH ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Bombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

REJUVENATED SONS OF JOVE. Jupiter, R. L. Jaynes, Pittsburgh, Pa.; Mercury (Secretary), E. C. Bennett, St. Louis, Mo.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, H. S. Cooper, Galveston, Tex.

Street Railway Association of the State of New York. Secretary, J. C. Collins, Rochester, N. Y.

Vermont Electrical Association. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention St. Louis, Mo., Jan. 27-30, 1913.

Western Society of Engineers. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, Tuesday after Jan. 1 each year.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Wisconsin Electrical Contractors' Association. Secretary, Albert Petermann, Milwaukee, Wis. Summer meeting, Waupaca and Chain-of-Lakes, Wis., August, 1912.

Wisconsin Institute. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 23, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,023,791. UNIVERSAL ELECTRIC INDUCTION HEATING ELEMENT; J. L. Anderson, Ogden, Utah. App. filed Oct. 30, 1911. Two tubular nested members forming a transformer.

1,023,846. APPARATUS FOR USE IN SYNCHRONOUSLY OPERATING COMBINED KINEMATOGRAPHS AND SOUND-PRODUCTION APPARATUS; C. M. Hepworth, London, England. App. filed June 23, 1909. Synchronously reciprocated devices.

1,023,861. SECONDARY BATTERY; P. Marino, London, England. App. filed Feb. 23, 1909. Active material of glycerine and alkaline silicate, soluble starch and lead powder.

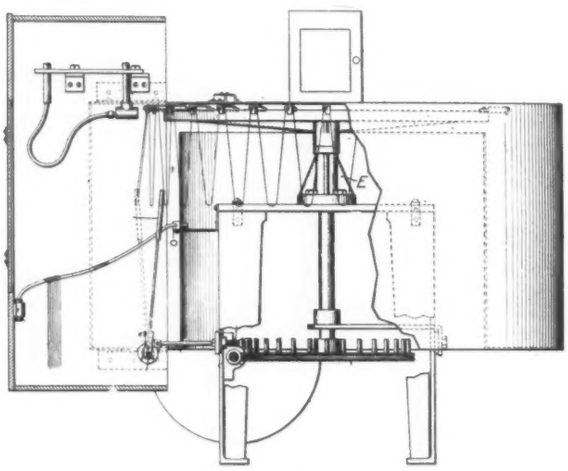
1,023,875. ELECTRIC SIGNAL APPARATUS; W. S. Reynolds, Shelby, Ohio. App. filed March 17, 1911. For sounding alarms at a plurality of distributed points.

1,023,886. VIBRATION STOP GOVERNOR; J. E. Snyder, Swissvale, Pa. App. filed Oct. 11, 1910. For turbines.

1,023,900. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed March 19, 1909. A ringing key and apparatus for calling a party from central.

1,023,916. LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed March 16, 1907. A support is secured to the side of the body of the shell.

1,023,917. CONDUCTING MATERIAL AND METHOD OF PRODUCING THE SAME; E. Bennett, Pittsburgh, Pa. App. filed June 2, 1899. Conducting material is subjected to an oscillating current of high potential and frequency to increase its specific resistance.



1,024,185.—Machine for Forming Filaments.

1,023,929. ROTARY-MAGAZINE FUSE BOX; L. D. Epperson, Kansas City, Mo. App. filed Sept. 23, 1911. A rotary cylinder with a plurality of fuses.

1,023,942. LAMP HOLDER; W. Klement, Neu-Finkenkrug-Falkenhain, Germany. App. filed Dec. 2, 1911. A cylindrical base for an incandescent lamp.

1,023,943. INDICATING AND PROTECTIVE DEVICE; D. R. Knapp, Philadelphia, Pa. App. filed Dec. 29, 1908. For use in training guns and turrets.

1,023,948. PROCESS OF TREATING WOOD FOR USE IN SECONDARY BATTERIES; P. Marino, London, England. App. filed Feb. 23, 1909. The wood is freed from extractive and fermentable substances and the solubles of distillation.

1,023,979. STARTER FOR ELECTRIC MOTORS; G. H. Whittingham, Pikesville, Md. App. filed March 28, 1911. Resistance-controlling mechanism and a main switch.

1,023,980. MOTOR STARTER; G. H. Whittingham, Pikesville, Md. App. filed June 5, 1911. Remote control for a combined main switch and starting device.

1,023,996. ELECTRIC FURNACE; M. R. Conley, New York, N. Y. App. filed Feb. 15, 1911. Resistance type; tilting body.

1,024,021. GROUND CLAMP; H. W. Pleister, Westfield, N. J. App. filed Nov. 3, 1910. A stool, strap and key.

1,024,026. ELECTROMECHANICAL DEVICE; G. H. Rowe, Berwyn, Ill. App. filed May 19, 1910. Electromagnetic drill.

1,024,027. ELECTROMECHANICAL DEVICE; G. H. Rowe, Chicago, Ill. App. filed April 26, 1912 Electromagnetic hammer.

1,024,061. ELECTRIC GAS ALARM; C. C. Clark, Guyandotte, W. Va. App. filed Nov. 29, 1910. Sounds an alarm when the gas supply is cut off.

1,024,088. SIGNAL TRANSMITTER FOR TELEPHONE EXCHANGES; G. W. Lorimer, Piqua, Ohio. App. filed April 11, 1906. Substation equipment for semi-automatic work.

1,024,104. METHOD OF SEPARATING AND PURIFYING FULLER'S EARTH AND ANALOGOUS MATERIALS; C. C. Ruprecht, Blakely, Ala. App. filed Aug. 5, 1910. Organic impurities are electrolytically destroyed.

1,024,129. ELECTRIC LAMP SOCKET; G. W. Goodridge, Bridgeport, Conn. App. filed June 4, 1909. The wires pass through holes in the porcelain to terminate on the sides.

1,024,131. DETECTOR FOR PARTY-LINE TELEPHONES; H. Y. Haley, Rushsylvania, Ohio. App. filed Feb. 24, 1908. Magneto call box.

1,024,184. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; G. Deakin, Berkeley, Cal. App. filed Feb. 2, 1911. Improvement in connectors of the Keith and Erickson type patent, No. 815,176.

1,024,185. MACHINE FOR FORMING FILAMENTS; L. E. Dempster, Schenectady, N. Y. App. filed Dec. 18, 1911. Automatic machine for squirting the material into loops and severing the loops.

1,024,205. PRINTING TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed April 3, 1909. Dots and dashes are differentiated by a difference in polarity.

1,024,218. METER; W. J. Mowbray, Providence, R. I. App. filed June 21, 1909. Commutating-type integrating watt-hour meter.

1,024,225. ELECTRIC GENERATOR; B. P. Remey, F. I. Remey, F. P. McDermott, Jr., and I. J. Reuter, Anderson, Ind. App. filed Jan. 16, 1911. For automobile ignition and lighting systems, etc.

1,024,233. APPARATUS FOR CONTROLLING THE TRAFFIC ON SINGLE-LINE RAILWAYS; E. Tyer, Dalston, London, England. App. filed Oct. 10, 1910. A magazine and tablet system.

1,024,234. ELECTRIC HEATING UNIT; T. Van Aller, Schenectady, N. Y. App. filed May 11, 1908. A flattened helix bent back and forth in parallel lines.

1,024,238. INTERLOCKING DEVICE FOR REMOTE-CONTROL SWITCHES; C. Wiler, Chicago, Ill. App. filed Oct. 19, 1908. To prevent the closure of more than one switch at a time.

1,024,248. COMBINATION BINDING POST; P. H. Capper and L. F. McCreary, Pittsburgh, Pa. App. filed Aug. 9, 1911. A resilient clip device particularly for cable-box terminal heads.

1,024,251. SWITCH FOR PROGRESSIVE LIGHTING; G. T. Fielding, Jr., New York, N. Y. App. filed Feb. 28, 1911. For electric signs.

1,024,257. ELECTRODE; J. Harden, Schenectady, N. Y. App. filed April 27, 1905. Contains carbon and carbides of titanius boron.

1,024,290. TROLLEY; C. C. Snodgrass, New Martinsville, W. Va. App. filed Nov. 24, 1911. Pressure lubricating device.

1,024,293. TROLLEY; P. Szuminsky, Hamilton, Ontario, Canada. App. filed Dec. 4, 1911. Swiveled trolley harp.

1,024,304. ELECTRICAL PULL SOCKET; D. P. Wolhaupter, Washington, D. C. App. filed June 17, 1911. Mechanical movement.

1,024,353. COMBINED TRACK AND TROLLEY-SWITCH-OPERATING MECHANISM; J. E. Nicholson, Elkhart, Ill. App. filed Feb. 15, 1911. Movement of the switch also throws the trolley.

1,024,365. PULL SOCKET; F. L. Rowntree, Hartford, Conn. App. filed Oct. 24, 1911. Lamp-switch mechanism.

1,024,368. TROLLEY; W. Schweppe, Pittsburgh, Pa. App. filed Aug. 30, 1911. A guard and harp attachment.

1,024,410. ROTARY ELECTRIC TRANSFORMER AND MOTOR GENERATOR; J. C. MacFarlane and H. Burge, Chelmsford, England. App. filed Feb. 7, 1910. Single-ring armature type.

1,024,418. INDUCTOR-ALTERNATOR; E. Podlesak, Tiffin, Ohio. App. filed March 14, 1911. Particularly for motor ignition systems.

1,024,444. AUTOMATIC SIGNAL OPERATOR; E. R. Gill, Yonkers, N. Y. App. filed Oct. 17, 1908. For high-speed selective telephone signals.

1,024,445. SELECTIVE SIGNALING SYSTEM; E. R. Gill, Yonkers, N. Y. App. filed Dec. 8, 1909. Railroad train dispatching.

1,024,446. SIGNALING SYSTEM; E. R. Gill, Yonkers, N. Y. App. filed Dec. 8, 1909. Train dispatching; time standardizing.

1,024,448. BATTERY-CHARGING APPARATUS; E. A. Halbleib, Rochester, N. Y. App. filed April 3, 1911. Automatic electromagnetic cut-out.

1,024,449. GONG-STRIKING MECHANISM; H. J. Heeney, Brookline, Mass. App. filed Sept. 30, 1909. Electromechanical.

1,024,487. TELEPHONE EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed Nov. 13, 1907. Automatic central switch for interconnecting subscribers.

1,024,463. POLE CHANGER; E. M. Tormin, Brookline, Mass. App. filed Feb. 1, 1909. For party line telephone selective signaling.